Consumer Federation of America

BEFORE THE

DEPARTMENT OF ENERGY

ENERGY CONSERVATION PROGRAM	**)**	
ENERGY CONSERVATION STANDARDS	**)**	**EERE-2017-BT-STD-0003**
FOR REFRIGERATORS, REFRIGERATOR-FREEZERS,	**)**	
AND FREEZERS	**)**	

Comments of The

CONSUMER FEDERATION OF AMERICA

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I. Introduction and Summary: Overview of Commentors and Findings

These comments are divided into three parts. Section 1 is the introduction and summary. Section 2 describes the general approach to analyzing standard setting for energy-consuming durable goods used by residential consumers. In Section 3, we examine the specific proposals for setting standards for refrigerators and clothes washers. Given the fact that the basic concerns about standard setting apply to refrigerators and clothes washers, the similarities of our concerns with the analysis of refrigerators and clothes washers, and the closeness of the filing deadlines (less than a week apart), we have combined the comments in a single document.

A. The Consumer Federation of America

Over the past two years, the Consumer Federation of America (CFA) has filed over three dozen comments in proceedings involving the energy consumption of consumer durables regulated by the Department of Energy and the Environmental Protection Agency.[1] While we have called on the DOE to do more, sooner to deliver the benefits of improved energy efficiency, we have also been supportive of what has been accomplished in a short, two-year period. The issues CFA has commentated on are broad, as shown in Table 1.

Table 1: Issues Dealt with in Previous Filings

<u>A dozen energy consumer durables</u> Conventional Cooking Product, Residential Dishwashers, Consumer Boilers, General Service and Incandescent Lamps, Microwave Ovens, Air Cleaners, Furnaces and Furnace Fans, Battery Chargers, Air Cleaners, Cooking Products, and Water Heaters.	**<u>Half a dozen process issues affecting regulation of energy consuming durables</u>** rulemaking, prioritization, interpretations, categorization, definitions, and test procedures

Taken together, these energy-consuming durables involved in these proceedings[2] represent are important, constituting over 10 percent of home electricity use and almost $180 per year of household expenditures.[3] DOE estimate about $60 billion in operating cost savings for consumers with a net pocketbook savings of almost $40 billion of the life of the energy-consuming durable covered by these rules. CFA has been commenting on the benefits of efficiency standards for decades, not just the years since the Biden administration began. In fact, we made this point emphatically in a late 2021 filing under the title, *Trump's $2 Trillion Mistake, The "War On Energy Efficiency: The "command-but-not-control" approach of fuel economy and energy efficiency performance standards delivers consumer pocketbook savings, grows the*

[1] Most of these are available on CFA's website under the testimony and comment sections of the Energy Issue.
[2] Department of Energy, 10 CFR Part 430 [EERE–2017–BT–STD–0003] RIN 1904–AD80, Energy Conservation Program: Energy Conservation Standards for Refrigerators, Refrigerator-Freezers, and Freezers, Federal Register / Vol. 88, No. 38 / Monday, February 27, 2023 (Hereafter Fed. Reg. Refrigerators); Clothes Washers: Department of Energy, 10 CFR Part 430 [EERE–2017–BT–STD–0014] RIN 1904–AD98. Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers. Federal Register / Vol. 88, No. 42 / Friday, March 3, 2023 (Hereafter Fed. Reg. Clothes Washers).
[3] For 2019 (i.e. pre-pandemic) Perch Energy, December 20, 2022. https://www.perchenergy.com/blog/energy/what-appliances-use-most-electricity-home); Sparkenergy, https://www.sparkenergy.com/appliance-electricity-use/

economy and protects public health.[4] The obvious theme was that the assault on efficiency launched by the previous administration was a *$2 Trillion Mistake.*[5] Correcting the mistake of reversing energy efficiency standards is most obvious and received the big headlines in the freeze and rollback of the auto efficiency standards. Fuel economy standards account for about half ($1 trillion) of the potential savings we calculated as a result of correcting the mistake. Each appliance efficiency decision has a smaller impact; taken together they are just as large. In fact, the other $1 trillion was impacted by energy efficiency of household energy-consuming durables. Refrigerators and clothes washers are very important examples of such appliances in those analyses.[6] Needless to say, the proposed rules are a continuation of the effort to correct the mistake of the past administration.

In these comments, we support the standards for refrigerators and clothes washers and note that DOE could do more. Our support is consistent with a long-term trend of public support of such standards, as we have noted in earlier analysis.[7]

B. SUMMARY OF FINDINGS

In this comment, we focus on the specific proposal for each class of appliances. We ask whether DOE would do a better job of implementing its charge to set standards to improve the energy efficiency (and in the case of clothes washers the efficiency of water use) if it moved each standard to the next highest level. In every case, the answer is yes, although the strength of the answer varies. The broader, more fundamental issues which crosscut all of the standards and support a higher level qualitatively, and discussed in the next section, before we move on to the specifics of each product class. In this introduction, we focus on the general conclusion about standards in the two broad categories of durables, refrigerators, and clothes washers that are the subject of ongoing proceedings.

In reviewing the standards for the many product classes of refrigerators, it is clear that DOE has chosen to set the standard at the lowest life cycle cost (LCC), That may seem reasonable, but as discussed below, and throughout these comments, it is inconsistent with the statute or sound public policy, but as discussed below. Therefore, in Table 1, we consider a standard at one higher level of efficiency, using a dozen and a half characteristics. The criteria we use for evaluating the standard in Table 2 is the complete list of criteria we will use in examining each of the individual product classes. Some of them are not provided by DOE Therefore, where possible, we have used the simple average of the product classes as the basis for comparison. In the case of % energy savings, we calculate the increase for level I to the proposed level plus 1.

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4 Page references in the tables and notes are to the original document submitted to the Department of Transportation in Comments of the Consumer Federation of America, Before the Department of Transportation, In Re Notification of Regulatory Review: 14 CFR Chapters I, II, and III, 23 CFR Chapters I, II, and III, 46 CFR Chapter II, 48, CFR Chapter 12, 49 CFR Chapters I, II, III, V, VI, VII, VIII, X, and XI, December 1, 2017. Passenger cars and Light Duty Vehicles, Parts of this document were submitted to the Department of Energy, the Department of Transportation, and the Environmental Protection agency under the title *Pocketbook Savings, Macroeconomic Growth and other public Benefits of Fuel Economy Standards,* The complete document was submitted to the Department of Transportation in Comments of the Consumer Federation of America, Before the Department of Transportation, In Re Notification of Regulatory Review: 14 CFR Chapters I, II, and III, 23 CFR Chapters I, II, and III, 46 CFR Chapter II, 48, CFR Chapter 12, 49 CFR Chapters I, II, III, V, VI, VII, VIII, X, and XI, December 1, 2017. The title of that paper is

5 The original title was *Trump's $2 Trillion Mistake, the "War On Energy Efficiency: The* "command-but-not-control" approach of fuel economy and energy efficiency performance standards delivers consumer pocketbook savings, grows the economy and protects public health. Hereafter the reference is *Trump's $2 Trillion Mistake,*

6 *Trump's $2 Trillion Mistake,,* Chapters, XV,XVII and XVIII.

7 *Trump's $2 Trillion Mistake,,* Chapters, VIII.

TABLE 2: EVALUATION OF PROPOSED STANDARD, EFFICIENCY LEVEL PLUS ONE

	Refrigerator.	Clothes Washer	Sources (Tables) Refrigerators	Clothes washers
Technology and Energy Savings				
1, Technically feasible	Y	Y	iv.5, 6; v.2	iv.9,14,19
2. Saves more energy, value in quads	1.25,	.77	iv.4,8,9	iv.6,8,34; v.1,2,3
3. Value as %	26%	53%	iv.4,8,9	iv.4,6,8,34;
4/ Climate & public health value (b $)	22.3	7.28	i.4; v.35	i.2,3
5 External B % of net pocketbook	52%	50.1%	i.4	i.3
Economically Justified				
6. LCC status (+ or -)	+	+	i.3; v.3-21	i.2,3; v.8,12
7. yields pocketbook B/C > 1	Y	Y	i.5; v.3-21	i.4
8. yields Total B/C >1,	4.04	2.46	i.4,5, v.3-21	1.4
9. Primary pocketbook B/C	2.66	2.09	v.49	v.39
10 Low pocketbook	2.25	1.98	v.49	v.39
11. High pocketbook	2.98	2.38	v.49	v.39
12. Operating cost savings > 0	Y	Y	i.4,5	i.3,4
Payback Yrs, & as % of Appl Life				
13. Net Pocketbook Yrs.	4.9	4.6	i.3,4; v-3,4	v.8-13
14. Net Pocketbook % of appliance life	37%	33%	i.3,4; v-3,4	v.8-13
15. Total Benefit Yrs.	3.2	3.1	i.4; v-3,4	i.3;v.8-13
16. % of appliance life	24%	22%	i.4; v-3,4	i.3;v.8-133
% Neg impact				
17. Base Case				
18. % point increase.	1.8%	-4.0	v.45,46	v.15-18
19. Total %				
Decrease in industry finances v. as % of consumer pocketbook benefit				
20 . Producer cost (sum of INPV, free cash $ & conversion. b$)	2.34	2.03	v.26	v.20,37 .
21. Cost as % of net pocketbook gain	16.2%	8%	i.3;v.26	v.37
22. Employment	Unclear	Unclear	v.27	v.21 .
Low income				
23, Housing Tenure (rent/own, pay utils.)				iv.36
24 LCC savings	Greater	Greater	v.23	v.16,18
25. Payback Period	Shorter	Shorter	v.23	v.16,18
26. % negative	Lower	Lower	v.23	v.16,18

Definitions of Evaluation Criteria

	Technology & Energy Savings, Efficiency Level (EL)	DOE's defined levels of efficiency
1	Technically feasible	DOE obligation, met by available in the marketplace
2	% of Max Tech or	DOE, percent of maximum technology used
	or infra marginal tech	DOE, technology is used by some other appliance
3	Saves more energy (in quads) as % pf use	DOE obligation, lower energy use must be "significant," reduced water consumption
4	Climate & public health	Value of reduction in emissions to climate change for Ill-health
5	External as % of net pocketbook	Value of Externalities/net pocketbook benefits
	Economically Justified	DOE obligation, consideration of consumer and producer impacts
	Life cycle cost status	Lower (good) higher (bad)
6.	Consumer Surplus	Aggregate savings
7	Pocketbook B/C > 1	Pocketbook savings > Cost
8	Total % B/C . 1	Impact on energy use of l level higher efficiency

9	Primary	Base Case B/C
10	Low	Higher cost, lower Savings case
11	High	Lower cost, Higher Savings case
12	Energy saving (%)	Value of pocketbook saving (%)
	Payback % of Appl Life	DOE Presumption (actuals exceed)
13	Net Pocketbook Yrs	Years to break even, Pocketbook only
14	Payback Yrs/Appl Life	Years to break even pocketbook/Appl Life
15	Total B Yrs	Years to break even, Total Benefits
16	Total B Yrs/ Appl life	Years to break even Total/Appl Life
	% neg, impact	Consumers who suffer higher LCC cost
17	Base %	Consumers who suffer higher LCC cost
18	% point Incr.	Increase in consumer with bill increase
19	Total %	Total base case plus increase
	Decrease in industry finances v. as % of consumer pocketbook benefit	
20	Producer cost	Total cost (INPV, Free Cash, Conversion)
21	Cost as % of net pocketbook gain	Total Cost/Consumer pocketbook net.
22	Employment	Direct employment
	Low income compared to all	
23	Housing Tenure	Rent/own responsible for Utils
24	LCC savings	LCC saving as % of LCC
25	Payback Period	Years to break even, Pocketbook only
26	% negative	Consumers who suffer higher LCC cost

Sources: Refrigerators: Department of Energy, 10 CFR Part 430 [EERE–2017–BT–STD–0003] RIN 1904–AD80, Energy Conservation Program: Energy Conservation Standards for Refrigerators, Refrigerator-Freezers, and Freezers, Federal Register / Vol. 88, No. 38 / Monday, February 27, 2023; Clothes Washers: Department of Energy, 10 CFR Part 430 [EERE–2017–BT–STD–0014] RIN 1904–AD98. Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers. Federal Register / Vol. 88, No. 42 / Friday, March 3, 2023

We believe that the proposed standard plus one higher level of efficiency is superior. It is

- technically feasible
- saves more energy.
- takes account of consumer climate and public health benefits.
- economically justified.
- increases LCC saving (with the exception of two product classes that do not consume or save much energy)
- yields a benefit-cost ratio greater than 1
- delivers more consumer pocketbook surplus
- has an acceptable payback period
- while its negative incremental impact is modest.

When other effects that have not been measured in the analysis are taken into account. the attractiveness increases. The most important of these are the macroeconomic benefits of reduced energy consumption, a lower discount rate, the likelihood of a lower cost of compliance because of the capitalist, competitive nature of the industry, and the clear evidence that low-income households disproportionately benefit from increased efficiency standards.

In spite of the emergence of a general approach in the laws, executive branch guidance and litigation, and widespread public and bipartisan support, there remain important areas of debate that we examine in this section before we outline our specific approach. Needless to say, the analysis is deeply affected by the manner in which these key decisions are handled. Table 3. identifies the issues we address in these comments in terms of their magnitude, measured as a percentage of the average base case benefits. The message here is simple, but extremely important since all of them mean that DEO has underestimated the positive impact of the standards. If any of these were taken into account, the case for not weakening, and perhaps strengthening the standards would be much stronger.

TABLE 3: MAJOR POINTS OF DEBATE IN BENEFIT-COST ANALYSIS

Type of Benefit	As a % of Base Case Net Benefits	Current Proceeding
Macroeconomic benefits	60%	60%
Value of Environment/Public Health	33% - 50%	50-52%
Discount Rate	40%	75%
Tendency of costs to decline	30%	30%

Source: *Trump's $2 Trillion Mistake*, p. 114.

As suggested by the review of executive branch guidance, the response has been to make the benefit-cost-benefit analysis as rigorous as possible, while recognizing that qualitative considerations could drive decisions to support broader or more aggressive standards. Even without considering broader qualitative issues, there are a number of important issues within the quantitative benefit-cost frame that are extremely important.

Of course, this higher standard has some negative consequence; it may:

- lower producer surplus slightly, but the foregone increase in consumer surplus that would result from a higher standard is much larger amount)
- increase the payback period!
- increase the % of consumers negatively affected.

None of these outweigh the convincing evidence for a higher standard. In fact, if DOE took the major "unaccounted" benefits in Table 3 into account, (even at half the level we identified), it would strongly shift the analysis in favor of stronger standards. The DOE has chosen to let the latter negative effects of a higher standard (increasing energy savings by one level) outweigh the former. positive effects. CFA believes that the potential benefits are too large to ignore. Although CFA respectfully disagrees with DOE's choice, we recognize that striking a balance is necessary. In demonstrating the superiority of setting the standards at a higher level of efficiency, we demonstrate that there certainly are no reasons to lower the standard. It could (perhaps should) be higher, but it certainly should not be lower.

II. General Issues

In these comments, we begin (in Part II) with the analysis of general issues in writing rules. We present a broad analysis of the significance of efficiency gains from regulation of the energy consumption of household durables. In providing analysis of efficiency regulation, we note that DOE "welcomes comments on any aspect of this proposal, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this document." In the comments, we tailor issues that have been raised earlier and presented to all the agencies involved in writing standards.

We are well aware of the specific concerns and questions raised by DOE, which broadly fall into the following categories:

Product identification, categorization, features, market shares, data sources

Technology – baseline, lifetime, cycling, development timing, capacity constraints

Cost estimation: Markups, Market shares, negatively impacted groups (including rebate programs)

Regulatory burdens, testing procedures, compliance periods, small businesses

Climate change and non-monetizable effects

We are also well aware of the many (often conflicting) considerations the DOE must take into account in setting standards.[8] We are equally aware that the industry will cite these considerations as justification for adopting less stringent standards. On the contrary, when we examine the various consideration that go into the DOE choice of a standard, we see strong evidence that each of the considerations suggests DOE should adopt a more stringent standard. Our broad analysis addresses each of these categories in several ways. Moreover, there are a number of very important fundamental issues, like discount rates and market processes that we also note influence the decision on where to set standards.

A. Competitive Market Structure and "command-but-not-control" Regulation[9]

Early on the DOE notes that the markets for refrigerators are moderately to highly competitive.[10] We agree, and this has very important implications for the analysis and decision-making. It is the key condition for what we have called "command-but-not control" regulation, which is what DOE is engaged in.

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[8] Fed. Reg. Refrigerators, Technological Feasibility (pp. 12436, 453, 458); Maximum Energy Savings (pp. 12453, 463, 473); If Significant (pp. 12458, 464);. Payback period (p12457.

[9] *Trump's $2 Trillion Mistake*,, Chapter III. In each section, in addition to reviewing the general arguments, we provide citations to at least on of the ongoing rulemakings. Key Implications of the general analysis involve cost estimates, Fed. Reg. Refrigerators (p. 12456), Mark-up (pp. 12464,, 12 478), and Little likelihood of anti-competitive impact Fed. Reg. Refrigerators, pp. xx, Fed. Reg. Clothese

[10] Fed. Reg. Refrigerators (pp.12478-12480).

1. Market Imperfections and Policy Responses: "Command-but-not-Control[11]

In this approach, the agency sets a goal, a standard, and producers are allowed to meet that standard however they see fit. Because they face competition, each producer will choose those technologies and implementation strategies that best reflect their abilities. This has important implications for market and producer performance. The producers, capitalists in a competitive market, will do what they do best, meeting the standards will be met in the least cost manner possible. We have identified six characteristics of a market in which "command-but-not-control" regulation is introduced, see Table 3.

TABLE 3: ELEMENTS OF COMMAND-BUT-NOT-CONTROL" REGULATION

Long-Term: Setting a high standard for the next fifteen years is intended to foster and support a long-term perspective for automakers and the public, by reducing the marketplace risk of investing in new technologies. The long-term view gives the automakers time to re-orient their thinking, retool their plants and help re-educate the consumer. The industry spends massive amounts on advertising and expends prodigious efforts to influence consumers when they walk into the showroom. By adopting a high standard, auto makers will have to expend those efforts toward explaining why higher fuel economy is in the consumer interests. Consumers need time to become comfortable with the new technologies.

Product Neutral: The new approach to standards accommodates consumer preferences; it does not try to negate them. The new approach to standards is based on the footprint (size) of the vehicles and recognizes that SUVs cannot get the same mileage as compacts. Standards for larger vehicles will be more lenient, but every vehicle class will be required to improve at a fast pace. This levels the playing field between auto makers and removes any pressure to push consumers into smaller vehicles.

Technology-neutral: Taking a technology-neutral approach to the long-term standard unleashes competition around the standard that ensures that consumers get a wide range of choice at the lowest cost possible, given the level of the standard. There will soon be hundreds of models of electric and hybrid vehicles using four different approaches to electric powertrains (hybrid, plug-in, hybrid plug-in, and extended range EVs), offered across the full range of vehicles driven by American consumers (compact, mid-size family sedans, large cars, SUVs, pickups), by half a dozen mass-market oriented automakers. At the same time, the fuel economy of petroleum-powered engines can be dramatically improved at consumer-friendly costs and it will continue to be the primary power source in the light-duty fleet for decades.

Responsive to industry needs: Establishing a long-term performance standard recognizes the need to keep the standards in touch with reality. The standards can be set at a moderately aggressive level that is clearly beneficial and achievable. With thoughtful cost estimates, consistent with the results of independent analyses of technology costs, a long-term performance standard will contribute to a significant reduction of cost.

Responsive to consumer needs: The approach to standards should be consumer-friendly and facilitate compliance. An attribute-based approach ensures that the standards do not require radical changes in the available products or the product features that will be available to consumers. We include the principle that standards should be attributed based as the key to this criterion. Consumers purchase and use durables for specific purposes. The attributes of the durables are extremely important. To the extent that agencies design standards to ensure consumers get the functionalities they need, the standards will be more effective. The setting of a coordinated national standard that lays out a steady rate of increase over a long-time period gives the market and the industry certainty and time to adapt to change.

Procompetitive: All of the above characteristics make the standards pro-competitive. Producers have strong incentives to compete around the standard to achieve them in the least cost manner, while targeting the market segments they prefer to serve. Well-designed performance standards that follow these principles command but they do not control. They ensure consumer needs are met while delivering energy savings and increasing consumer and total social welfare.

Source: *Trump's $2 Trillion Mistake*, Chapter IV.

All of these characteristics exist in the market for refrigerators and clothes washers. We briefly note them here because they have important implications for the current proceeding. Above all, "Command-But-Not-Control" sets the conditions for a regulatory path that maintains the functionality of the appliances are a continuously declining price. DOE notes this process is

[11] *Trump's $2 Trillion Mistake,,* Chapter III.

observable in the case of its prior standards[12] and, rightly, expects it to continue in the response to the current rules.

The foundation on which effective standards rest is the identification of market imperfections that need to be addressed. While these will be defined by the specific consumer durable or energy use being analyzed, it is important to note at the start that there is a vast literature that documents market imperfections, as a general proposition. Table 4 lists the full array of market failures, barriers, and imperfections that cause the underinvestment in energy-saving technologies.

TABLE 4: IMPERFECTIONS POTENTIALLY ADDRESSED BY STANDARDS

Societal Failures[2]	Structural Problems[3]	Endemic Flaws	Transaction Costs	Behavioral[4]
Externalities[5]	Scale[6]	Agency[7]	Sunk Costs, Risk[8]	Motivation[9]
Information[10]	Bundling[11]	Asymmetric Information	Risk & Uncertainty[12]	
				Perception[13]
	Cost Structure[14]	Moral Hazard	Imperfect Information[15]	Calculation[16]
	Product Cycle			Execution[17]
	Availability[18]			
	Product differentiation[19]			
	Incrementalism[20]			

Source: Framework developed in Comments of the Consumer Federation of America, Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, Environmental Protection Agency 40 CFR Parts 86 and 600, Department of Transportation 49 CFR Parts 531,633, 537, et al., November 28, 2009

Even with well-documented market imperfections, there is no guarantee that the standards will deliver the benefits they claim. The design of standards is important. Viscusi, et al., describe several attributes of regulation that improve its efficacy, stating that "performance-oriented regulation," gives firms some discretion in terms of the means of their compliance," "utilization of unbiased estimates of benefits and costs," and "avoid… regulation of prices and production."[13] This observation is often repeated with respect to energy efficiency performance standards. Other key characteristics that the literature identifies as making for effective standards that promote innovation, in addition to flexibility, include certainty of standards, progressive moving targets, and elimination of information asymmetry.[14]

There is a lot of empirical evidence that energy savings measures often provide an effective, cost-efficient approach to reducing greenhouse gas emissions while generating co-benefits on employment and competitiveness…

Well-designed regulation that is strict in ambition, but flexible in implementation would point companies to the problem of inefficiencies, trigger information gathering, reduce uncertainty, and create a market push within an overall level-playing field. Compliance to regulations will lead to greater innovation (cleaner technologies, processes) as key means to reduce inefficiency, which will lead to environmental benefits, hence lower overall costs.

[12] Fed. Reg. Refrigerators, pp. Fed. Reg. C
[13] W. Kip Viscusi, John M. Vernon and Joseph E. Harrington, Jr., *Economics of Regulation and Antitrust* (MIT, 2001), pp. 35-37.
[14] Luke Stewart, 2010, The Impact of Regulation on Innovation in the United States: A Cross-Industry Literature Review, Institute of Medicine Committee on Patient Safety and Health IT, June.

Moreover, cost savings can (but do not always) lead to partial or full offset of regulatory compliance and innovation cost and hence increase overall competitiveness.[15]

Of utmost importance in our framework, we find that, "command but not control" performance standards work best when they embody six principles, which are clearly at the core of the national efficiency standards.

Evaluations of policy options to close the efficiency gap[16] consistently find that standards that require consumer durables to use less energy are a very attractive approach to closing the gap. Energy performance standards address many of the most important market barriers and imperfections. They tend to reduce risk and uncertainty by creating a market for energy-saving technologies, lower technology costs by stimulating investment in and experience with new technologies, reduce the need for information and the effect of split incentives, all of which help to overcome the inertia of routine and habit. However, the literature points out that performance standards have positive effects if they are well-designed, enforced, and updated. The current approach to standard setting, which is technology-neutral, product-neutral, and long-term, transforms standards into consumer-friendly, procompetitive instruments of public policy.

B. Historic Performance of Regulatory Cost Estimation[17]

The existence of competitive markets and the "command-but-not-control" approach to regulation combine to limit the price increase to the minimum level. Even though regulators take learning into account,[18] they have a tendency to overestimate the ultimate cost of compliance,

Market imperfections and the availability of policy responses to reduce them are the key background conditions that justify policy action. The availability of energy/pollution reducing technologies at a cost that makes them attractive (less than the cost of energy use and the harm it imposes) is the immediate trigger for policy. Ironically, the starting point of the analysis of one of the most anti-regulation groups is not only the agency estimate of the costs of standards,[19] but they fail to take the pocketbook savings into account. They have also used the costs estimated by the agencies in their technical and regulatory analyses, with a 3% discount rate. We believe this is the appropriate basis for the analysis, but it only makes sense if you include the pocketbook savings, and it is only the starting point.

The costs presented by the agencies are an appropriate starting point because the agencies tend to spend an immense amount of time analyzing these costs, including technology and maintenance. They do not just accept the high costs suggested by industry or the low costs put forward by efficiency advocates. They do independent analysis of costs, frequently engaging in engineering (tear down) studies and reviewing the technical literature, as well as numerous reports from the National Research Council of the National Academy of Sciences.[20] Although,

[15] Institute for European Environmental Policy, Review of Costs and Benefits of Energy Savings: Task 1 Report 'Energy Savings 2030, May 2013 IEER, pp. 4…6.
[16] *Trump's $2 Trillion Mistake,*, Chapter XV, XVII,. Implications for Declining price and Improving quality (pp. 12476 – 482.
[17] *Trump's $2 Trillion Mistake,*, Chapter X.
[18] Fed. Reg. Refrigerators, pp. 12480-1248.
[19] American Action Forum, *Regulatory* Rodeo.
[20] National Academy of Sciences analyses have played a large part in the estimation of vehicle technology costs.

as discussed below, the regulatory agencies still tend to overestimate costs because they do not fully reflect the dynamic, cost-reducing effects of market forces and market-driven innovation, their cost estimates are the best place to start and anchor the analysis.

As noted above, policies to reduce the efficiency gap, like performance standards, will systematically improve market performance.[21] By overcoming barriers and imperfections, well-designed performance standards will stimulate investment and innovation in new energy-efficient technologies. A natural outcome of this process will be to lower not only the level of energy consumption but also the cost of doing so. The efficiency gap literature addresses the question of how "learning curves" will affect the costs of new technologies as they are deployed. There are processes in which producers learn by experience to lower the cost of new technologies dramatically. The strong focus on the supply-side and innovation underlies the observation that well-designed, aggressive policies to stimulate innovation and direct technological change can speed the transition and lower the ultimate costs.

In the efficiency gap area, the issue of declining costs driven by technological change has received significant examination as a natural extension of the effort to project technology costs. One of the strongest findings of the empirical literature is to support the theoretical expectation that technological innovation will drive down the cost of improving energy efficiency and reducing greenhouse gas emissions. A comprehensive review of *Technology Learning in the Energy Sector* found that energy efficiency technologies are particularly sensitive to learning effects and policy.

For demand-side technologies, the experience curve approach also seems applicable to measure autonomous energy efficiency improvements. Interestingly, we do find strong indications that in this case, policy can bend down (at least temporarily) the experience curve and increase the speed with which energy efficiency improvements are implemented. 1. For the past several decades, the retail price of appliances has been steadily falling while efficiency has been increasing. 2. Past retail price predictions made by the DOE analysis of efficiency standards, assuming constant price over time, have tended to overestimate retail prices. 3. The average incremental price to increase appliance efficiency has declined over time. DOT technical support documents have typically overestimated the incremental price and retail prices. 4. Changes in retail markups and economies of scale in production of more efficient appliances may have contributed to declines in prices of efficiency appliances [22]

The findings on learning curve analysis are extremely important because decisions to implement policies that promote efficiency and induce technological change are subject to intensive, *ex ante* cost-benefit analysis. Analyses that fail to take into account the powerful process of technological innovation that lowers costs will overestimate costs, undervalue innovation, and perpetuate the market failure. Detailed analysis of major consumer durables including vehicles, air conditioners, and refrigerators finds that technological change and pricing strategies of producers lowers the cost of increasing efficiency in response to standards.

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[21] Performance Standards, 2013, pp. 28-32.
[22] Larry Dale, et al., "Retrospective Evaluation of Appliance Price Trends," *Energy Policy* 37, 2009. p. 1.

The more specific point here is that, while regulatory compliance costs have been substantial and influential, they have not played a significant role in the pricing of vehicles. Vehicle prices have steadily increased over time, far exceeding the costs of emission control and safety equipment…

These cost increases, to the extent they are substantial, are dealt with in the short run by a variety of pricing and marketing strategies and by allocating R&D costs further into the future and over more future models. As with any new products or technologies, with time and experience, engineers learn to design the products to use less space, operate more efficiently, use less material, and facilitate manufacturing. They also learn to build factories in ways that reduce manufacturing costs. This has been the experience with semiconductors, computers, cellphones, DVD players, microwave ovens – and also catalytic converters.

Experience curves, sometimes referred to as "learning curves," are a useful analytical construct for understanding the magnitude of these improvements. Analysts have long observed that products show a consistent pattern of cost reduction with increases in cumulative production volume. …

In the case of emissions, learning improvements have been so substantial, as indicated earlier, that emission control costs per vehicle (for gasoline internal combustion engine vehicles) are no greater, and possibly less, than they were in the early 1980s when emission reductions were far less.[23]

A comparative study of European, Japanese, and American auto makers prepared in 2006, before the recent reform and reinvigoration of the U.S. fuel economy program, found that standards had an effect on technological innovation. The U.S. had lagged because of the long period of dormancy of the U.S. standards program and the fact that the U.S. automakers did not compete in the world market for sales, (i.e. it did not export vehicles to Europe or Japan).[24]

Figure 1 shows the systematic overestimation by regulators of the cost of efficiency-improving regulations in consumer durables. The cost of household appliance regulations was overestimated by over 100%, and the costs for automobiles were overestimated by about 50 percent. The estimates of the cost from industry were even father off the mark, running three times higher for auto technologies.[25] Broader studies of the cost of environmental regulation find a similar phenomenon, with overestimates of cost outnumbering underestimates by almost five to one with industry numbers being a "serious overestimate."[26]

We perform counterfactual simulation of firms' pricing and medium-run design responses to the reformed CAFE regulation. Results indicate that compliant firms rely primarily

[23] Sperling, Dan et al., 2004, Analysis of Auto Industry and Consumer Responses to Regulation and Technological Change and Customization of Consumer Response Models in Support of AB 1493 Rulemaking, Institute of Transportation Studies, UC Davis, June 1, pp. 10-15.

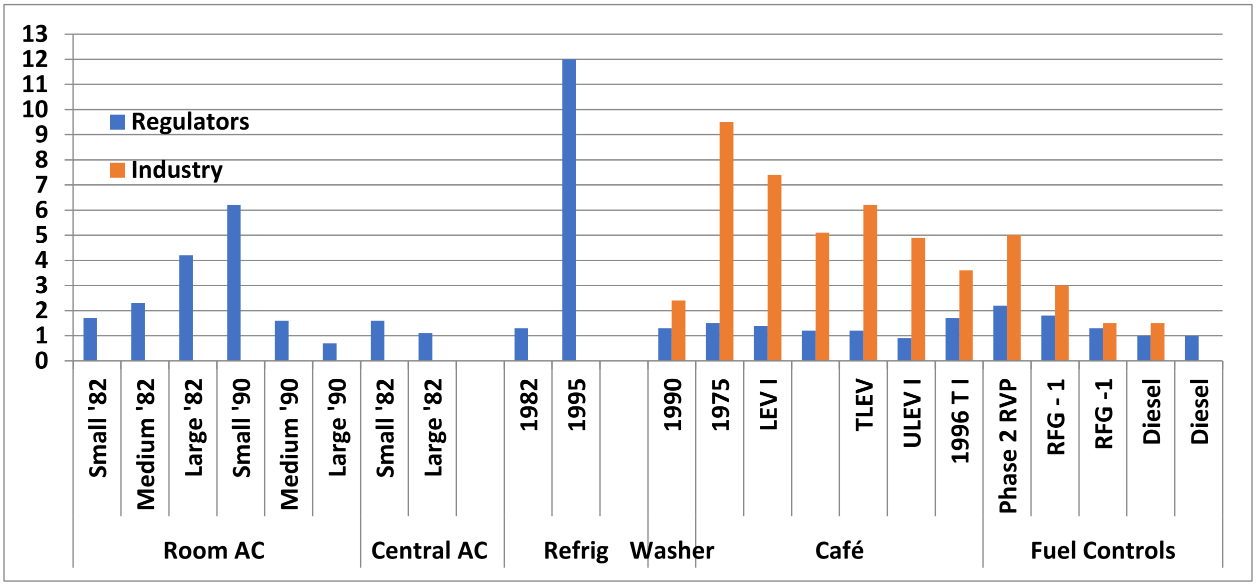
[24] Kuik, On, 2006, *Environmental Innovation Dynamics in the Automotive Industry:* Project Assessing Innovation Dynamics Induced by Environmental Policy. November 3.

[25] Hwang, Roland and Matt Peak, 2006, Innovation and Regulation in the Automobiles Sector: Lessons Learned and Implicit on for California CO_2 Standards, April.

[26] Harrington, Winston, 2006, Grading Estimates of the Benefits and Costs of Federal Regulation: A Review of Reviews, Resources for the Future, September, p. 3.

on changes to vehicle design to meet the CAFE standards, with a smaller contribution coming from pricing strategies designed to shift demand toward more fuel-efficient vehicles... Importantly, estimated costs to producers of complying with the regulation are three times larger when we fail to account for tradeoffs between fuel economy and other vehicle attributes.[27]

FIGURE 1: THE PROJECTED COSTS OF REGULATION EXCEED THE ACTUAL COSTS: RATIO OF ESTIMATED COST TO ACTUAL COST BY SOURCE



Sources: Winston Harrington, Richard Morgenstern and Peter Nelson, "On the Accuracy of Regulatory Cost Estimates," *Journal of Policy Analysis and Management* 19(2) 2000, *How Accurate Are Regulatory Costs Estimates?*, Resources for the Future, March 5, 2010; ; Winston Harrington, *Grading Estimates of the Benefits and Costs of Federal Regulation: A Review of Reviews,* Resources for the Future, 2006; Roland Hwang and Matt Peak, *Innovation and Regulation in the Automobile Sector: Lessons Learned and Implications for California's CO_2 Standard,* Natural Resources Defense Council, April 2006; Larry Dale, et al., "Retrospective Evaluation of Appliance Price Trends," *Energy Policy* 37, 2009.

While the very high estimates of compliance costs offered by the auto manufacturers can be readily dismissed as self-interested political efforts to avoid regulation, they can also be seen as a worst-case scenario in which the manufacturers take the most irrational approach to compliance under an assumption that there is no possibility of technological progress or strategic response. A simulation of the cost of the 2008 increase in fuel economy standards found that a technologically static response was 3 times costlier than a technologically astute response.

CFA presented a historical analysis of cost increases associated with mandates that reflects the ability and strategy of producers to keep cost increases within the broad limits of industry practices. Many of the factors that are cited as causes of the declining cost, such as learning, standardization and homogenization of components, competitive outsourcing of components, and technological improvements in broader socio-economic environment) represent market factors or externalities that are difficult for individual firms to control or profit from (appropriate), so they constitute externalities that policy must address, if the externalities are to be internalized in transactions. At the same time, performance standards simply shift the

[27] Whitefoot, Kate, Meredith Fowler and Steven Skerlos, 2012, Product Design Response to Industrial Policy: Evaluating Fuel Economy Standards Using an Engineering Model of Endogenous Product Design, Energy Institute at Haas, May, pp. 1…5.

baseline of competition to a higher level of energy efficiency. To the extent that markets are competitive, normal competitive processes drive down the costs of innovation such as competition-driven technological change, declining markups, and economies of scale.

Even more fundamentally, there is evidence that the decision to increase energy efficiency can stimulate broader innovation and productivity growth.

The case-study review suggests that energy efficiency investments can provide a significant boost to overall productivity within industry. If this relationship holds, the description of energy-efficient technologies as opportunities for larger productivity improvements has significant implications for conventional economic assessments... … This examination shows that including productivity benefits explicitly in the modeling parameters would double the cost-effective potential for energy efficiency improvement, compared to an analysis excluding those benefits.[28]

C. Historic Performance of Appliance Efficiency Standards[29]

The track record of efficiency standards for five household consumer durables is excellent. Data on the efficiency of these devices has been compiled since then and it covers the period in which natural gas prices were deregulated. Efficiency is measured as the decline in energy use compared to the base year, which is set equal to 1. The performance of the furnace market is quite deficient with respect to energy efficiency, which has had and continues to have the weakest standards by far.

Examining the trends for individual consumer durables in Figures 2 and 3 suggests three important observations. First, the implementation of standards improved the efficiency of the consumer durables. Second, furnaces have been far less efficient than they should have been, since the DOE has set and maintained weak standards. Third, after the initial implementation of a standard, the improvement levels off, suggesting that if engineering-economic analyses indicate that additional improvements in efficiency would benefit consumers, the standards should be strengthened on an ongoing basis.

Price

The engineering-economic analysis indicates that although the standards may increase the cost of the consumer durable, the reduction in energy expenditures is larger, resulting in a net benefit to consumers. We have also pointed to evidence that the costs of energy-saving technologies tend to be smaller than the *ex-ante* analysis suggests because competition and other factors lower the cost. The experience of the implementation of standards for the household consumer durables is consistent with this interpretation. While the efficiency was increasing, the cost of the durables was not, as shown in Figure 2 which focuses on refrigerators and clothes washers. There are five standards introduced for the four appliances in out earlier analysis. In three of the cases (refrigerators, clothes driers – second standard, and room air conditioners),

[28] Worrell, Ernst, et al., 2003, “Productivity Benefits of Industrial Energy Efficiency Measures,” Energy, 28(11): This examination shows that including productivity benefits explicitly in the modeling parameters would double the cost-effective potential for energy efficiency improvement, compared to an analysis excluding those benefits, p. 1081.

[29] *Trump’s $2 Trillion Mistake,*, Chapter XV,.

there was a slight increase in price with the implementation of the standard, then a return to a pre-standard downward trend. In one case (clothes driers – first standard) there was no apparent change in the pricing pattern. In one case (central air conditioners) there was an upward trend.

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FIGURE 2: APPLIANCE EFFICIENCY STANDARDS AND TRENDS (BASE YEAR EFFICIENCY = 1; ▲ = NEW STANDARD)

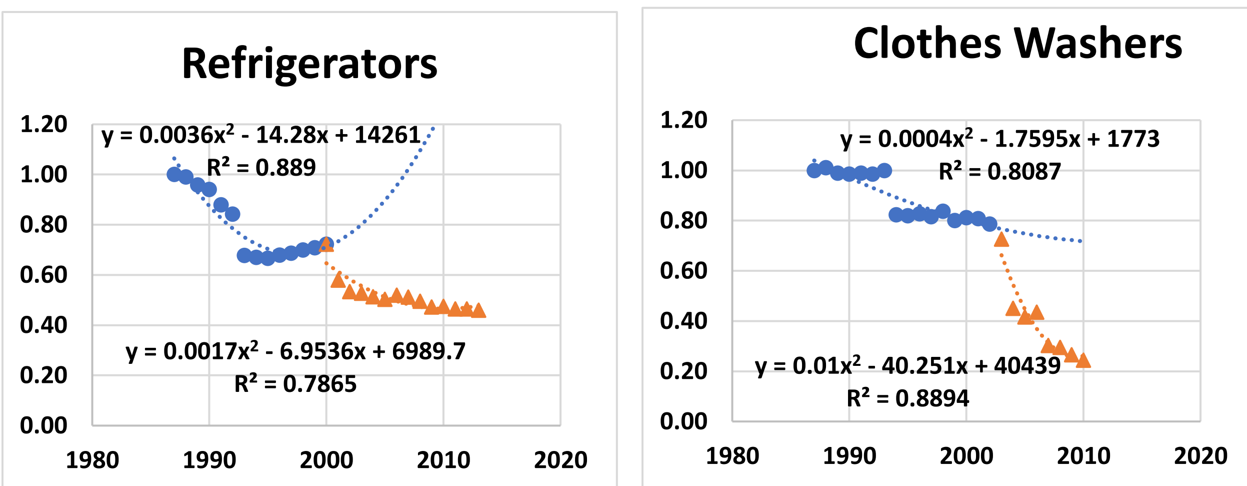
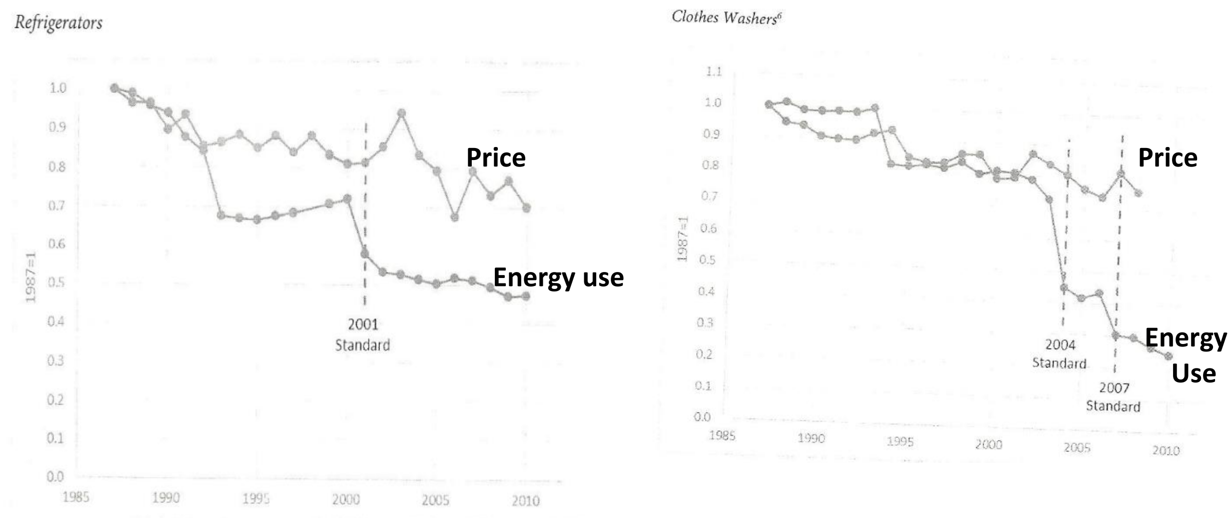


FIGURE 3: PRICE TRENDS AND STANDARDS



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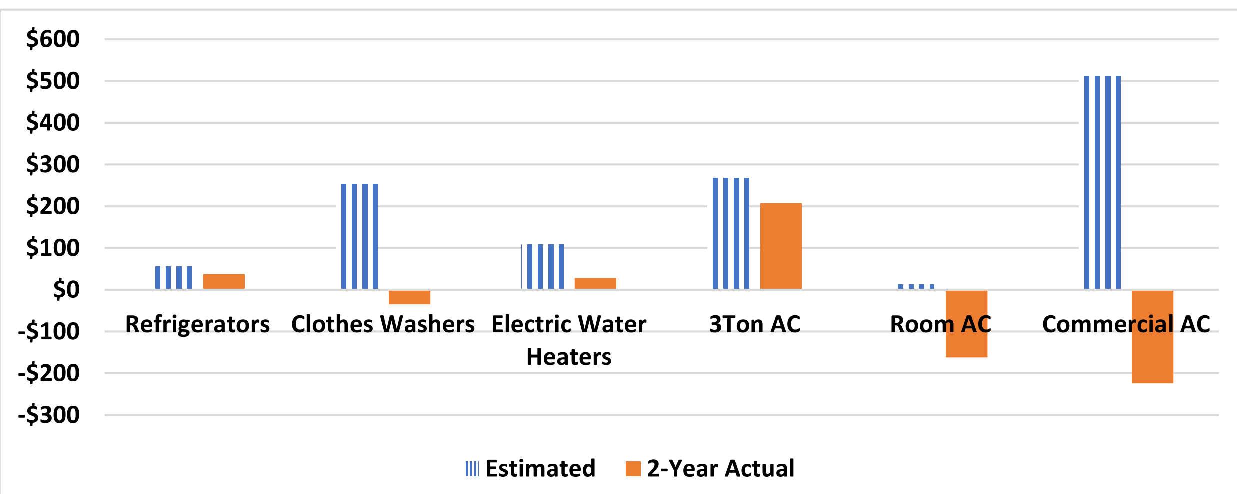
Sources: Nadel, Steven and Andrew deLaski, *Appliance Standards: Comparing Predicted and Observed Prices*, American Council for An Energy Efficient Economy, July 2013; *Steven* Nadel, Neal Elliott, and Therese Langer *Energy Efficiency in the United States:35 Years and Counting*, June 2015.

A recent analysis of major appliance standards adopted after the turn of the century shows a similar and even stronger pattern (see Figure 3). Estimated cost increases are far too high. There may be a number of factors that produce the result, beyond an upward bias in the original estimate and learning in the implementation, including pricing and marketing strategies.[30]

FIGURE 3: ESTIMATED AND ACTUAL COST INCREASES ASSOCIATED WITH RECENT STANDARDS FOR MAJOR APPLIANCES



Source: Steven Nadel and Andrew Delaski, *Appliance Standards: Comparing Predicted and Observed Prices*, American Council for an Energy Efficient Economy and Appliance Standards Awareness Project, July 2013.

We do not mean to suggest that the price increase was too big, compared to the engineering-economic analysis or that the standards lowered costs, although there are theories that would support such a rationale, (i.e. suppliers take the opportunity of having to upgrade energy efficiency through redesign to make other changes that they might not have made otherwise). However, this does indicate that the standards can be implemented without having a major, negative impact on the market.

The analysis of consumer durables also shows that there was no reduction in the quality or traits of the products. The functionalities were preserved while efficiency was enhanced at modest cost.

The impact of standards is statistically significant and quantitatively meaningful in all cases. The coefficient in column 6 (All Years, All Variables) indicates that the standard lowers the energy consumption by about 8%. This finding is highly statistically significant, with a probability level less than .0001. There is a very high probability that the effect observed is real.

Table 5 shows the results of econometric analysis of the data. The statistical analysis created (dummy) variables that identify each consumer durable and whether a standard was in place or not. We use the year to estimate the underlying trend. Table 5 shows what is obvious to the naked eye in Figures 2 and 3: Stricter standards as set by DOE lead to measurable improvements in appliance efficiency. Table 5 shows that the observations that are obvious to the naked eye in bivariate relationship in Figures 2 and 3 are statistically valid. We present two sets of models, one based on all years, and one based on shorter, five-year periods before and after the standards are adopted.

TABLE 5: MULTIVARIATE ANALYSIS OF APPLIANCE STANDARDS

Variable	Statistic	5-years before/after				All Years			
		1	2	3		4	5	6	
Standard	β	-.1637	-.1386	-.1086		-.2260	-.1079	-.0803	-
	Std. Err.	(..0485)	(.0587)	(.0382)	(.0366)	(.0414)	(.0227)		
	p <	.000	.023	.007		.000	.010	.001	
Trend	β	NA	-.0053	-.0111		NA	- .0107	-.0135	
	Std. Err.		(.0081)	(.008)			(.0026)	(.0019)	
	p <		.51	.176			.000	.000	
Refrig	β	NA	NA	-.2775		NA	NA	-.2242	
	Std. Err.			(.0382)			(.0289)		
	p <			.000				.000	
Washer	β	NA	NA	-.2889		NA	NA	-.2144	
	Std. Err.			(.0561)			(.0391)		
	p <			.000				.000	
RoomAC β		NA	NA	.0478		NA	NA	-.0895	
	Std. Err.			(.0642)			(.0321)		
	p <			.383				.009	
CAC	β	NA	NA	-.0050		NA	NA	.0383	
	Std. Err.			(.0292)			(.0260)		
	p <			.864				.143	
R^2	.20	.21		.85		.29	.36	.75	

Statistics are Beta coefficient and robust standard errors.

We have built this analysis in the typical way that multivariate regression analysis is conducted. The dependent variable is energy consumption with the base year set equal to 1. Later years had lower values. We introduce a variable to represent the adoption of a standard. This variable (known as a dummy variable) takes the value of 1 in every year when the standard was in place and a value of zero when it was not. A negative number means that the years in which the standard was in force had lower levels of energy consumption. Similarly, the difference between appliances is handled with dummy variables. We include each appliance except furnaces, which shows how the other appliance performed compared to furnaces. Again, a negative number means that the other appliances had lower levels of energy consumption.

The underlying trend is also statistically significant, suggesting that the efficiency of these consumer durables was improving at the rate of 1.35% per year. Given that the engineering-economic analysis had justified the adoption of standards and that standards were effective in lowering energy consumption, this means the market trend was not sufficient to drive investment in efficiency to the optimal level. We include the variables for consumer durables other than furnaces, which means the Beta coefficient measures the performance compared to furnaces. Negative numbers indicate that the energy use declined more for the consumer durable other than for furnaces. Refrigerators, clothes washers, and room air conditioners perform significantly better than furnaces. Central air conditioners show no statistically significant difference. Comparing the models with shorter terms to the all-year model is consistent with the earlier observation. The impact of the standard is greater (almost 11% in column 3) because we have eliminated the out years where the effect of the standard has worn off. The impact of the trend is slightly smaller (1.1% per year), but the statistical significance is greatly affected by shortening the period because we truncate the trend.

D. Conceptualizing DOE's Excessively Conservative Bias in Setting Standards

We have long argued that the bias among conservative economists in setting standards goes too far in protecting producers at the expense of foregoing a great deal of benefit that could be realized for consumers.[30] While we have noted this bias before, here we elaborate since it plays such an important part in the current proceedings. A perfect example can be found a text on *Antitrust and Regulatio*n authored by Viscusi, et al. See Figure 4.

The conservative approach pursues regulating non-market externalities (environmental, public health, safety) only up to the point where one finds the "largest spread between the total benefits and the total costs," rather than the point where the marginal benefits equal the marginal cost shown in upper graph of Figure 4. The reality of the first post-Energy Independence and Security Act, shown in the lower graph, is even more troubling since it does not get to the point where marginal benefit = marginal cost.

This decision is troubling because they stop the effort to reduce externalities at the maximum spread between benefits and costs (where marginal value equals marginal cost); consumers suffer a large loss of welfare because there are increased levels of efficiency that produce net benefits to consumers and it is consumers who bear the overwhelming cost of

[30]Statement of Dr. Mark Cooper to the Environmental Protection Agency on Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, Detroit Michigan, October 21, 2009; Consumer Federation of America, Re: Comments on National Highway Traffic Safety Administration Notice of Proposed Rulemaking; Docket No. NHTSA 2008-0089, RIN 2127-AK29; Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011-2015

externalities that have not been reduced. Producers (who bear at best a minuscule part of the harm) and much lower cost enjoy a larger increase in producer surplus.

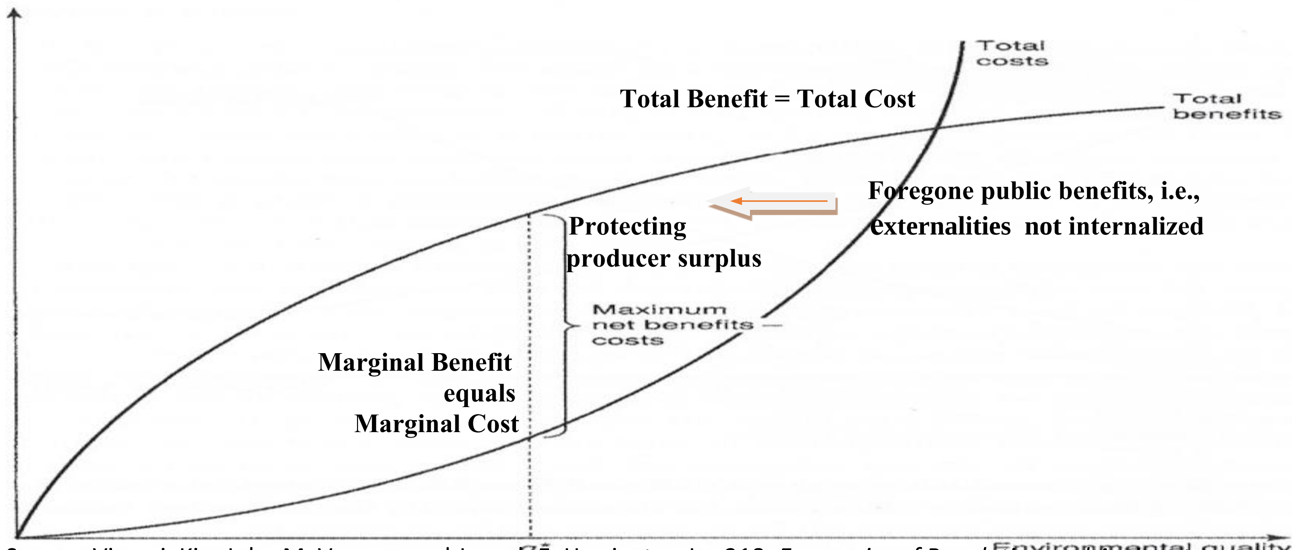
Figure 5 shows the problem in the current proceeding at two levels of detail. First, we show efficiency levels for an individual product class; then we show the trial level on average across all classes.

The choice of efficiency level for clothes washers is even more suspect. The DOE Hs not even set the standard to minimize LCC. That means that a higher standard is even more attractive. The analysis does not identify the low point on the LCC curve, but a standard at one higher level of efficiency is superior; for all the reasons cited above, plus the fact that DOE has not even captured all of the benefits available where marginal benefits qual marginal costs.

The DOE has chosen to let a small and uncertain reduction in producer surplus override a much larger increase in consumer surplus. The consumer loss ($6 billion) is over 15 times as large as the avoided producer loss (about $410 million). Although CFA respectfully disagrees with this choice, we recognize that striking a balance is necessary. In demonstrating the superiority of setting the standards at a higher level of efficiency, we demonstrate that there certainly are no reasons to lower the standard; it should be higher, but it certainly should not be lower.

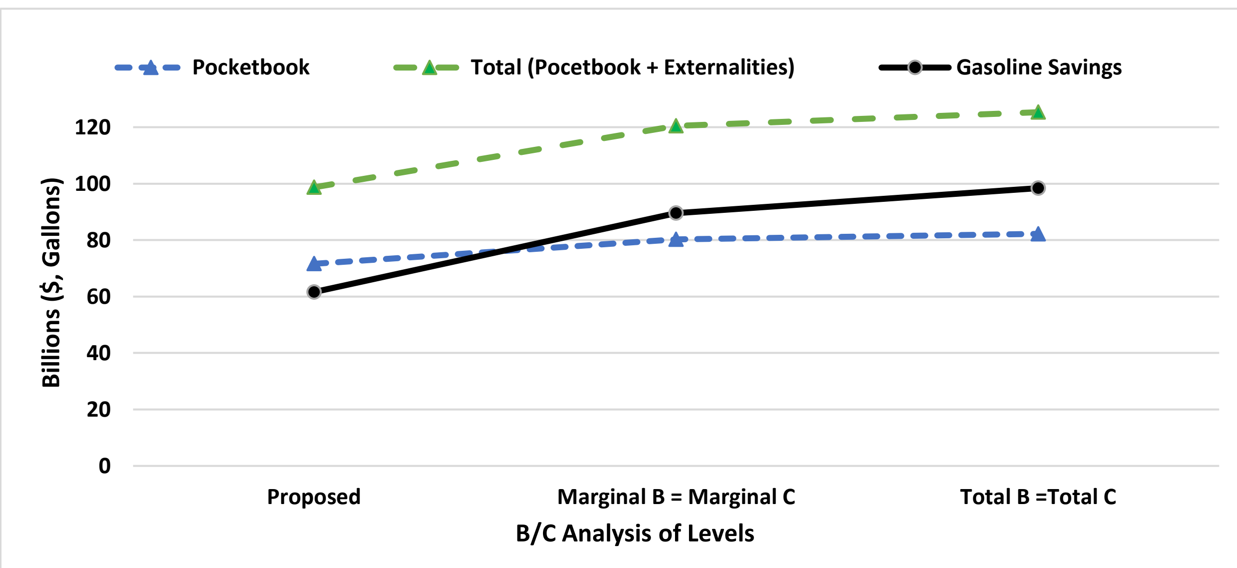
Figure 4: Conservative Benefit-Cost Analysis of Regulation

Leaving Consumer Surplus on the Table



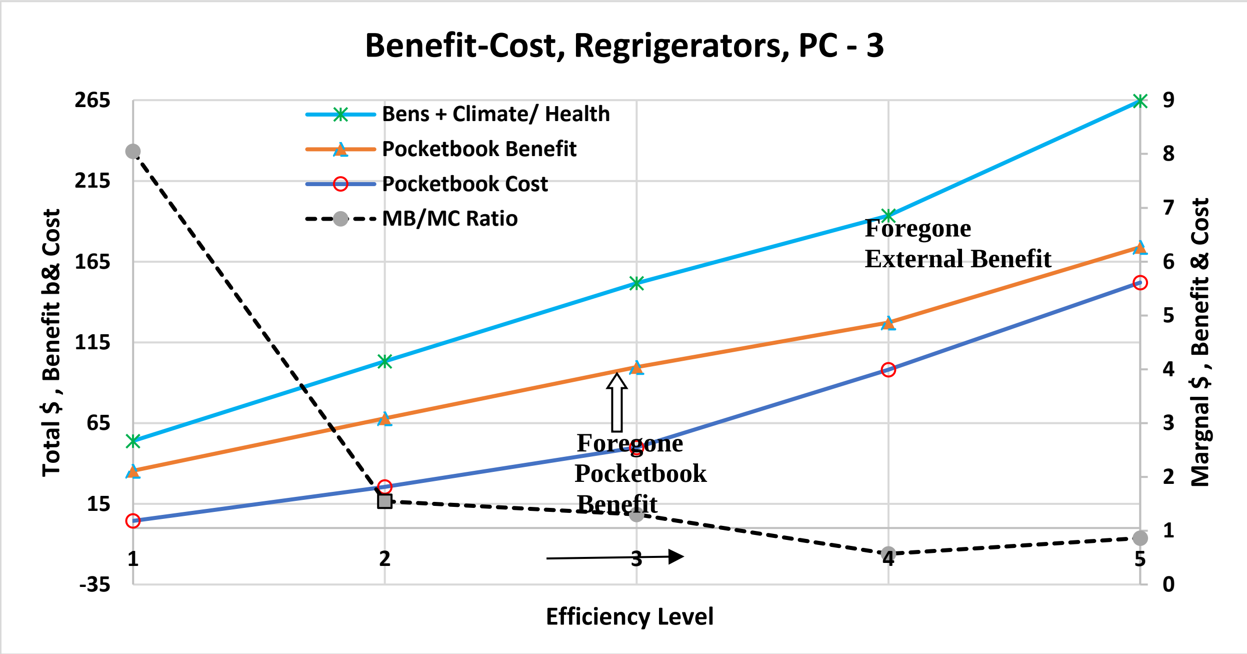
Source: Viscusi, Kip, John M. Vernon, and Joseph E. Harrington Jr., 218, *Economics of Regulation and Antitrust* (Cambridge, MA: MIT Press), p. 35.

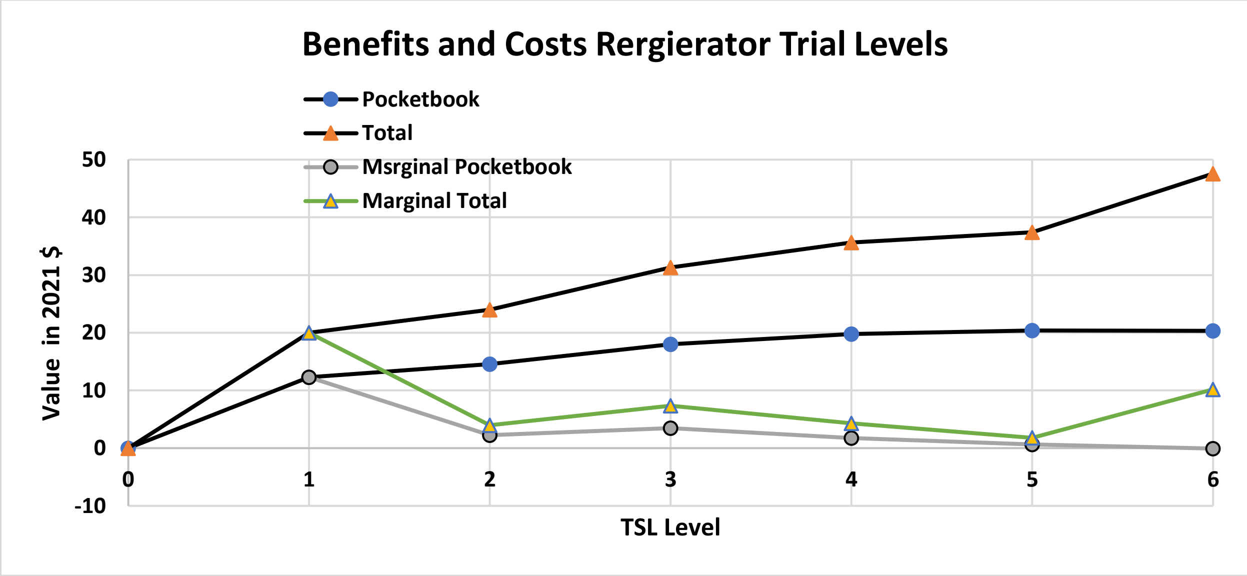
Leaving Consumer Surplus and Energy Savings on the Table in the First, Post-Energy Independence and Security Act Fuel Economy Standards



Source, Statement of Dr. Mark Cooper to the Environmental Protection Agency on Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards Detroit Michigan, October 21, 2009

FIGURE 5. BENEFITS AND COSTS OF REFRIGERATORS





Sources: Table V.3 for efficiency levels, Table v.45 for trial levels, Pocketbook Benefits, Total Cost, with marginals calculated. Table 1.4 for Climate and Public Health.

E. MACROECONOMIC IMPACT OF EFFICIENCY[31]

To the dismay of anti-standard, free market ideologues, and the surprise of consumers who end up with a more fuel-efficient durables than they thought they could get, fuel economy standards puts more money in the consumer's pocket. The inevitable result is to increase disposable income and, under any reasonable assumption, trigger the macroeconomic multiplier effect, which includes a consumption externality that lowers prices because of reduced energy

[31] *Trump's $2 Trillion Mistake*,, Chapter XI.

consumption. The environmental and public health benefits of reduced pollution are also realized.

We argue that one major externality has been present throughout the history of the energy efficiency standard-setting process and should be recognized in rigorous cost-benefit analysis. The macroeconomic stimulus that results from efficiency standards is a true externality, which Taylor broadly defined as "the situation in which the cost of producing or the benefits of consuming a good spill over onto those who are neither producing nor consuming the good."[32] These changes are invariably driven by the adoption of the rule and are not likely to be considered by the parties to the transaction.

The macroeconomic impact of energy policy has taken on great significance in the current round of decision-making. Every policy is evaluated for its ability to stimulate growth and create jobs. Assessing the macroeconomic impact of policy choice generally relies on complex models of the economy. Economically beneficial energy efficiency investments yield net savings; the reduction in energy costs exceeds the increase in technology costs. Such investments, in this case, have two effects from the point of view of the economy. The increase in economic activity resulting from spending on new technology and the increase in consumer disposable income flows through the economy, raising the income of the producers of the additional products that are purchased and increasing employment.

Expenditures are shifted from purchasing energy to purchasing technology, which has a larger multiplier. The decrease in energy expenditure is substantially larger than the increase in technology costs, resulting in an increase in the disposable income of individuals to spend on other things. This outcome reflects three effects. Direct and indirect growth comes from the economic activity (jobs) stimulated by the development and deployment of the energy saving technologies, which occurs directly in the new technologies and indirectly in the firms that supply new inputs for new technologies. Induced growth comes from the fact that the multiplier on energy spending is quite low compared to other activities. As disposable income is shifted from energy consumption to other goods and services, more economic activity is stimulated.

The increase in economic activity resulting from spending on new technology and the increase in consumer disposable income flows through the economy, raising the income of the producers of the additional products that are purchased and increasing employment. These large increases in economic activity leads to increases in employment. The effect is magnified by the fact that the non-energy sectors of the economy are substantially more labor-intensive than energy production. As shown in Figure 5, the energy sector is less than half as labor-intensive as the rest of the economy. This effect is compounded where energy is imported (as in the transportation sector). As consumers substitute away from energy, the goods and services they purchase stimulate economic and, disproportionately large, job growth.

The direct pocketbook savings of efficiency standards are the largest and most direct benefit of the standards, but this benefit has a second immediate and inevitable economic benefit. We have argued for at least a decade that the macroeconomic stimulus that results from shifting consumer spending from energy consumption to other goods and services is substantial. The

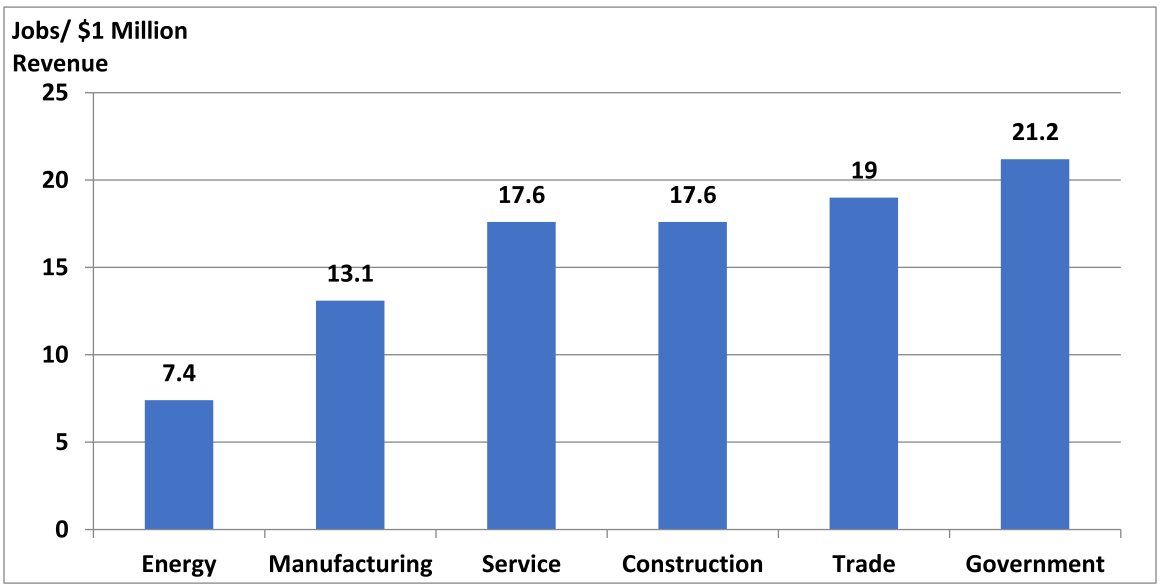
[32] Taylor, John B., *Economics*, (Houghton Mifflin,1998) p. 898.

academic literature supports the proposition that the higher multiplier on consumer disposable income results in an additional dollar of economic stimulus for each dollar of consumer savings.

The literature on energy efficiency has a large body of research on the positive impact of reduced energy consumption on economic output. While the economic externalities of energy consumption originally entered the policy arena through the study of the negative recessionary impact of oil price shocks,[33] the positive impact of energy efficiency is becoming widely recognized and consistently modeled.[34] Importantly, the literature now goes well beyond the negative national security and environmental externalities, which are frequently noted in energy policy analysis. The macroeconomic effects of energy consumption and energy savings are important externalities of the efficiency gap.

The studies by regulatory agencies also include a rebound effect. That is, consumers use part of the increase in pocketbook disposable income to do things that consume energy. From the environmental or energy reduction point of view, this is a negative. Reducing energy consumption or emissions of pollutants is more than the simple improvement in efficiency suggests. From the consumer point of view, this is a positive, not a negative. That is, the fact that consumers use some of the increased disposable income on energy indicates that they are using it to increase their utility.

FIGURE 5: LABOR INTENSITY OF KEY ECONOMIC SECTORS IN THE U.S.



Source: Rachel Gold, et al., *Appliance and Equipment Efficiency Standards: A Money Maker and Job Creator,* American Council for an Energy Efficient Economy, January 2011, p. 9, based on the IMPLAN Model, 2009.

[33] James D. Hamilton, "Causes and Consequences of the Oil Shock of 2007–08," *Brookings Papers on Economic Activity* Spring; Warr, Benjamin S, Robert U. Ayres, and Eric Williams, 2009, *Increase Supplies, Increase Efficiency: Evidence of Causality Between the Quantity and Quality of Energy Consumption and Economic Growth*. 2009/22/EPS.ISIC, Faculty & Research Working Paper. INSEAD.

[34] In addition to the recent U.S. analysis by U.S. EPA/NHTSA, 2011, see Jamie Howland, et al., 2009, *Energy Efficiency: Engine of Economic Growth.* Rockport, ME: Environment Northeast; and New York State Energy Research & Development Authority, 2011, *Macro-Economic Impact Analysis of New York's Energy Efficiency Programs: Using REMI Software.* Albany NY: NYSERDA, August 4; Holmes Ingrid and Rohan Mohanty, 2012, *The Macroeconomic Benefits of Energy Efficiency: The Case for Pubic Action*, E3G, April; Cambridge Centre for Climate Change Mitigation Research, 2006, *The Macro-Economic Rebound Effect and the UK Economy*. Cambridge, U.K.: Cambridge Econometrics and Policy Studies Institute, May; and Lisa, Ryan, and Nina Campbell, 2012, *Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements*. Insight Series. Paris, France: International Energy Agency, for a general global review.

The rule of thumb – an approximate doubling of the economic impact – that emerges in the literature reflects the observation on jobs.[35] Similarly, in a study of 52 examples of increases in industrial productivity, where benefit was monetized, the productivity savings were 1.25 times as large as the energy savings. Macroeconomic models measuring the outcome in change in GDP yield a "respending" effect that clusters around 90%.[36] Table 6 shows examples of the multiplier, with the GDP impact expressed as a multiplier of the value of net pocketbook savings. That is, we subtract costs from the estimated value of energy savings. This ensures we do not double-count benefits.

TABLE 6: ESTIMATES OF MACROECONOMIC MULTIPLIERS AS A MULTIPLE OF NET POCKETBOOK SAVINGS

Modeler	Model Date	Policy Assessed	Region	GDP/$ of Net Savings	
				Base Case	Rebound Adjustment
Roland-Holst	DEAR	Computer Standard	California	1.8	2.0
ENE	REMI	Utility Efficiency	Northeast	2.2	2.4
Cadmus	REMI	Utility Efficiency	Wisconsin	2.5	2.8
Arcadia	REMI	Utility Efficiency	Canada	2.7	3.0

Sources:
David Roland-Holst, 2016, *Revised Standardized Regulatory Impact Assessment: Computers, Computer Monitors, and Signage Displays,* prepared for the California Energy Commission, June. ENE, *Energy Efficiency: Engine of Economic Growth: A Macroeconomic Modeling Assessment*, October 2008. Cadmus, 2015, *Focus on Energy, Economic Impacts 2011–2014*, December. Arcadia Center, 2014, *Energy Efficiency: Engine of Economic Growth in Canada: A Macroeconomic Modeling & Tax Revenue Impact Assessment*, October 30,

This categorization and recognition of the broad benefits is not unique to energy efficiency standards. For example, a recent National Academy of Sciences Transportation Research Board report prepared for the Transit Cooperative Research Program, entitled, *Practices for Evaluating the Economic Impacts and Benefits of Transit,* noted that "Because of shifting demands and constrained budgets, transit agencies have an increasing need to consistently and defensibly document the economic impacts and benefits of the services they provide."[37] The report identifies direct and indirect benefits that are akin to those discussed in this section

Two primary forms of economic analysis are discussed in this report:

Impacts on the economy – most often referred to as "economic impacts" or "economic development impacts," which encompass effects on jobs and income: and

[35] ACEEE, "In our experience modeling efficiency investments, we find that re-spending the energy savings typically creates an equivalent number of jobs as implementing the investment." (p. 2)

[36] Ryan and Campbell, Ryan, and Campbell, 2012, *Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements.* Insight Series. Paris, France: International Energy Agency p. 5., Jamie Howland, et al., 2009, *Energy Efficiency: Engine of Economic Growth*. Rockport, ME: Environment Northeast; and New York State Energy Research & Development Authority, 2011.

[37] National Academy of Sciences Transportation Research Board report prepared for the Transit Cooperative Research Program, *Practices for Evaluating the Economic Impacts and Benefits of Transit* 2017, forward. This example is particularly appropriate since infrastructure spending and projects, on which transit would be an important area, appear to be widely supported because of the benefits they deliver to individuals and the economy

The economic valuation of broader societal benefits – sometimes referred to as "social welfare," benefits which encompass the valuation of "non-user benefits" (affecting quality of life, environments, and productivity) in addition to user benefits….

Economic impact = the study of the net change in economic activity (jobs, income, investment or value-added) resulting from a project, event, or policy.

Economic valuation of societal benefits = the social welfare value of prices ($) and non-prices (non-$) benefits associated with a project, policy or event. The non-priced benefits are assigned a value based on revealed or stated preference methods. [38]

This quote includes all the impacts we have identified and the approach to valuing them. We agree they are the building blocks of a comprehensive and rigorous benefit-cost analysis.

E. Externalities: Distributional Effects: Consumers, Particularly Low-Income, Benefit the Most[39]

The conservative bias in setting the level of benefits links up with the two other flaws in the DOE approach that have important implication for the discussion. In calculating the Benefit/Cost ratio, the DOE focuses on pocketbook savings and does not include the external benefits. These external benefits are overwhelmingly enjoyed by the vast body of consumers because they vastly outnumber the manufacturers. In fact, given where they live and the quality of their housing and healthcare, low-income households are disproportionately the beneficiaries of those externalities.

Although consumer pocketbook impacts take precedence in economic calculations, when they have clear individual-level impacts and from a national policy perspective, there is no reason to ignore them. A simple and obvious way to incorporate them is to add these benefits to the pocketbook total. This will ignore the small share the manufacturers enjoy, but that error is much smaller. In the analysis below, we show the dramatic impact that taking this approach has on the economics of the decision.

Here we briefly discuss the low-income aspect of externalities, which is qualitative. Because the companies incessantly repeat the unfounded claim that low-income households are hurt by efficiency standards, we conclude this section with two general observations. live in housing that is less resistant to pollution.[40] They are more exposed and are more susceptible to suffer from pollution. This issue has been recognized for decades.[41]

The first issue is that operating costs have a much greater impact on low-income expenditures; we repeat an obvious conclusion we have stated before (see Figure 6). The second general observation that must be made with respect to low-income households is that they also

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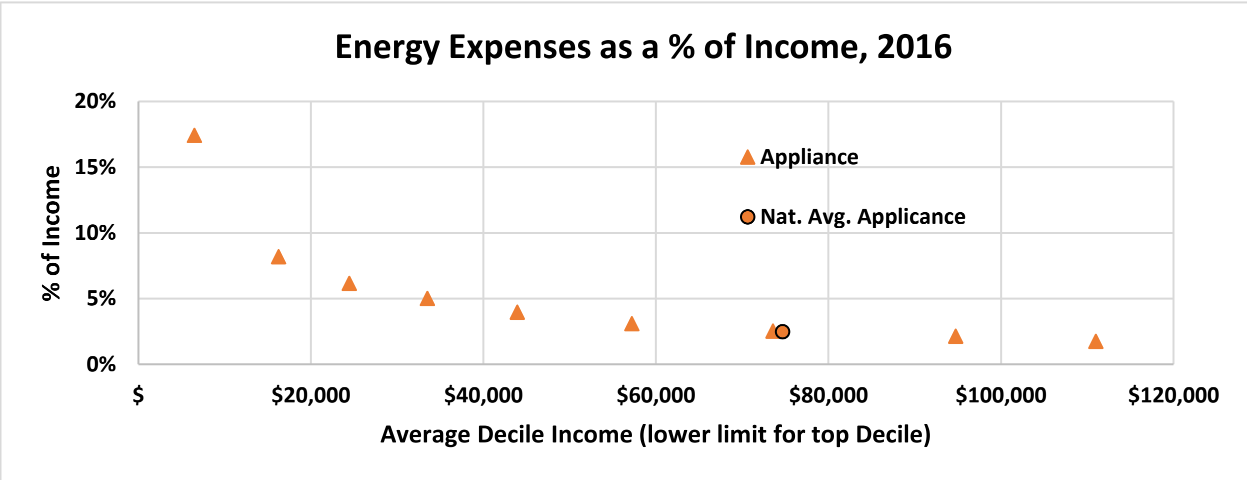
[38] Id., pp. 3… 10.
[39] Tr*ump's $2 Trillion Mistake,*, Chapter XIX.
40 Shrubole, C., et al., 2016, "Impacts of energy efficiency retrofitting measures on indoor PM2.5 concentrations across different income groups in England: a modelling study," Advances Building Energy Research, 10(1).
41 Faiz, Asif, Christopher S. Weaver and Michael P. Walsh, 1996, Air Pollution from Motor Vehicles: Standards and Technologies for Controlling Emissions, The World Bank.

suffer disproportionately from environmental pollution[42] (see Figure 7). It hardly seems necessary to make the point that the third outcome of efficiency standards, macroeconomic growth, would be to the benefit of low-income households.

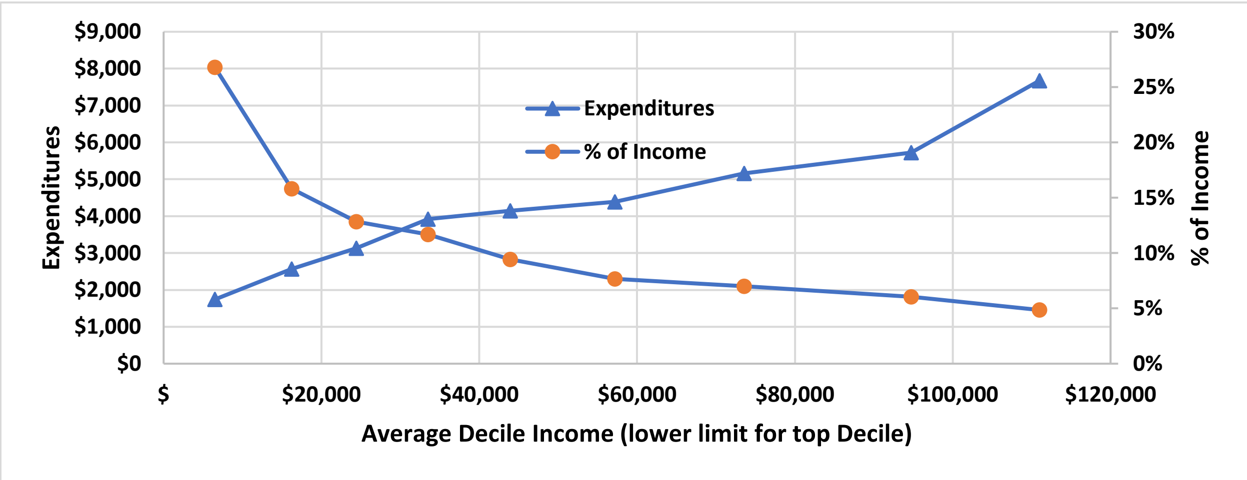
FIGURE 6: ENERGY AND HEALTH CARE EXPENDITURES COMPARED TO INCOME

Energy Expenditures as a % of Income



Source: Bureau of Labor Statistics, 2017, *Consumer Expenditure Survey; 2016, Deciles of Income.*

FIGURE 7: HEALTH CARE EXPENDITURES AND INCOME, 2016



Source: Bureau of Labor Statistics, 2017, *Consumer Expenditure Survey; 2016, Deciles of Income.*

They tend to live in areas that are most affected by pollution and have less resources to prevent, adapt or recover from the harms of pollution. They live closer to facilities that emit pollutants,[43] making them more vulnerable to the harmful effects of pollutant that have local and

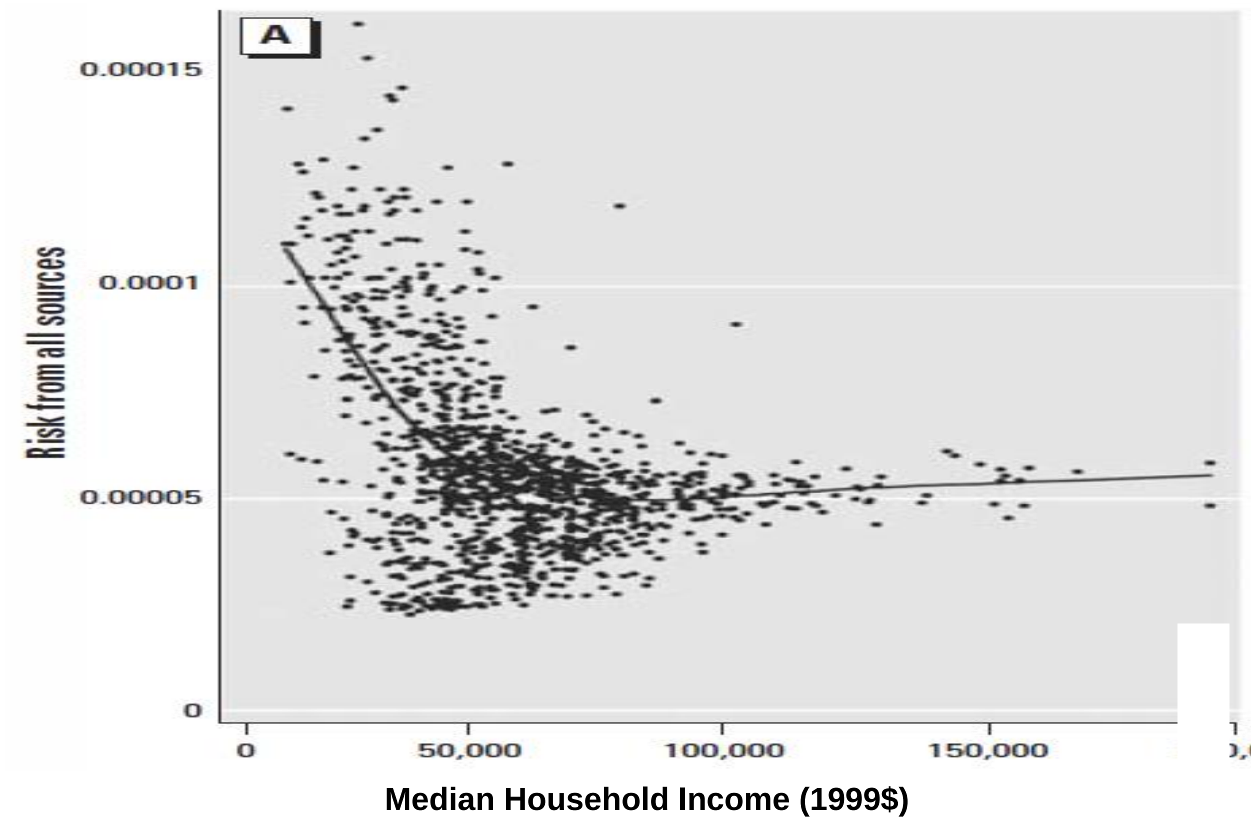
42 Miranda, Maie Lynn, 2011, "Making the Environmental Justice Grade: The Relative Burden of Air Pollution in the United States," Int. J. Environ. Res. Public Health,8(6).

43 Morello-Frosch, R. and B.M. Jesdale, 2006, "Separate and unequal: residential segregation and estimated cancer risks associated with ambient air toxics in U.S. Metropolitan areas," Environ. Health Perspect. 114(3); Fleischman, Lesley and Marcus Franklin, 2017, Fume Across the Fence Line, Clean Air, November.

regional impacts,[44] Figure 7 uses healthcare expenditures from the *Consumer Expenditure Survey* to make this point in a similar fashion as above for gasoline expenditures. Lower-income households have much less to spend on health care, but those expenditures account for a much larger share of their income.

This is certainly a very complex issue, but the evidence is overwhelming that lower income is associated with greater exposure to pollutants, which is associated with a higher incidence of the health problems associated with pollution. The graph of the data that underlies this conclusion, as shown in Figure 8, is crystal clear. Simply put, living close facilities that emit pollution raises the exposure to toxics and the risk and incidence of the related health effects. As one study put it,

FIGURE 8: CANCER RISK FROM AIR TOXICS V. MEDIAN HOUSEHOLD INCOME



Sources: Buckley, Timothy J, Ronald White, 2005, Socioeconomic and Racial Disparities in Cancer Risk from Toxics in Maryland," *Environmental Health Perspectives*, July, p. 696.

Census tracts in the lowest quartile of socioeconomic position, as measured by various indicators, were 10–100 times more likely to be high risk than those in the highest quartile. observed substantial risk disparities for on-road, area, and non-road sources by socioeconomic

44 Deguen, S. and D. Zmirou-Navier, 2010, "Social inequalities resulting from health risks related to ambient air quality – a European review," Eur J Public Health (1); Katz, Cheryl, 2012, "People in Poor Neighborhoods Breathe More Hazardous Particles," Scientific American, November 1.

measure and on-road and area sources by race. There was considerably less evidence of risk disparities from major source emissions.[45]

F. Discount Rates: A 3% Discount Rate is a "High" Estimate for Consumers and Society[1]

No matter how lofty the goal of policy, the use of the public's money (whether for increased costs for energy-consuming durables or to administer programs) to achieve a goal must not only deliver a benefit above the cost; it should also deliver a return at least as large as it could have if put to other uses. This is the opportunity cost of capital which is operationalized as the discount rate in the cost-benefit analysis.

In our analysis, we follow the typical agency practice by including pocketbook savings and environmental benefits, discounted at the 3% rate, while subtracting the rebound effect. In this section we explain why pocketbook savings should be included valued at the 3% discount rate or a lower discount rate.

Discounting over long periods of time has the effect of reducing the present value of dollars spent or saved later. However, when costs are incurred and benefits enjoyed over a long period, the benefit-cost ratio is less affected than the total dollar amount. This is particularly true with standards that increase over time, since the marginal cost of later savings are assumed to increase in real terms. At year 15, a discounted dollar is worth $0.66 at 3%, while it is worth $0.38 at 7%. At year 30, which tends to be the time horizon for the analysis, it is worth $0.42 at 3% and $0.14 at 7%. Since later values have less impact, the average value over 30 years is close to the mid-point value, $0.63 at 3% and $0.32 at 7%.

We have frequently argued that the 3% discount rate is the correct discount rate from the consumer point of view. It is a good, perhaps somewhat high estimate of the opportunity cost of consumer capital. It is also one of the anchor points ordered by the Office of Management and Budget (OMB), making it available in all formal agency evaluations.[46]

45 Buckley, Timothy J, Ronald White, 2005, Socioeconomic and Racial Disparities in Cancer Risk from Air Toxics in Maryland," Environmental Health Perspectives, July, p. 693. While this study was at the census track level in Maryland, other studies reach similar finding in metropolitan areas across the nation. See, for example, "Segregation and Black/White Differences in Exposure to Air Toxics in 1990," Lopez, Russ, 2002, Environmental Health Perspectives, 110, April., Three factors, Black/White poverty levels, percent employed in manufacturing, and degree of segregation as measured by the dissimilarity index, collectively explain over half the variation in the net difference score for exposure to air toxics in large U.S. metropolitan areas. Other potential factors, including overall income inequality, relative political power, and local variation in environmental regulation (64), may also affect net difference scores and should be included in future research…. The results here show that Blacks are more likely than Whites to live in census tracts with higher total modeled air toxics concentrations, partly because they are more likely than Whites to live in poverty, and poverty itself may be a risk factor for living in a poor-quality environment.

46 OMB Circular A-4, pp. 33-34. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. OMB revised Circular A-94 in 1992 after extensive internal review and public comment. In a recent analysis, OMB found that the average rate of return to capital remains near the 7 percent rate estimated in 1992. Circular A-94 also recommends using other discount rates to show the sensitivity of the estimates to the discount rate assumption… The effects of regulation do not always fall exclusively or primarily on the allocation of capital. When regulation primarily and directly affects private consumption (e.g., through higher consumer prices for goods and services), a lower discount rate is appropriate. The alternative most often used is sometimes called the social rate of time preference. This simply means the rate at which a society discounts future consumption flows to their present value. If we take the rate that the average saver uses to discount future consumption as our measure of the social rate of time preference, then the real rate of return on long-term government debt may provide a fair approximation. Over the last thirty years, this rate has averaged around 3 percent in real terms on a pre-tax basis. For example, the yield on 10-year Treasury notes has averaged 8.1 percent since 1973 while the average annual

The calculation of discount rates is highly variable and difficult to predict. We include borrowing as an alternative use of consumer credit. These capture the essence of the idea of the discount rate by proving metrics for the "alternative investments."

It is clear that the consumer discount rate is in the range of 1-3%. While federal agencies are required to consider 3% and 7%, this data shows that the 3% figure is a far better (perhaps even high) proxy for the opportunity cost of consumer capital. Reflecting this analysis, we have always focused on the agency analyses based on the 3% discount rate. The 3% discount rate is not only a somewhat high estimate of the consumer discount rate, but it also serves as a somewhat high estimate of the social discount rate when intergenerational and incommensurable impacts are being analyzed, as OMB Circular A-4 noted.

Some believe, however, that it is ethically impermissible to discount the utility of future generations. That is, the government should treat all generations equally. Even under this approach, it would still be correct to discount future costs and consumption benefits generally (perhaps at a lower rate than for intragenerational analysis), due to the expectation that future generations will be wealthier and thus will value a marginal dollar of benefits or costs by less than those alive today. Therefore, it is appropriate to discount future benefits and costs relative to current benefits and costs, even if the welfare of future generations is not being discounted. Estimates of the appropriate discount rate appropriate in this case, from the 1990s, ranged from 1 to 3 percent per annum.[47]

Emissions from clearly have intergenerational impacts, most notably in their impact on climate change. Therefore, for us, 3% is a reasonable compromise for the central analysis of the discount rate. Since it is generally available in agency analysis, we use it. A range would be justified, but the agencies which routinely report analyses with a 7% discount rate do not report (or conduct) analyses with a 1% discount rate.

2. High Implicit, Market Discount Rates are Misleading

The discount rate is linked to a broader and more fundamental issue. Some, citing the fact that the market exhibits a high "implicit" discount rate for energy efficiency, arguing that consumer pocketbook savings should not be counted at all. Opponents of regulation take the view that since there are choices in the marketplace, there can be no consumer utility gain from imposing standards. Consumers express their preferences and get what they want.

In a sense, the discount rate is the centerpiece of the market fundamentalist objection to performance standards, but it is based on a view that ignores all the market imperfections that inflate the discount rate.[48] In other words, the claim boils down to the belief that whatever the implicit discount rate the market puts on a decision must be right. Therefore, regulators must be

rate of change in the CPI over this period has been 5.0 percent, implying a real 10-year rate of 3.1 percent. For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent.

[47] OMB Circular A-4. pp. 35-36. Similar issues affect health impacts, "When future benefits or costs are health-related, some have questioned whether discounting is appropriate, since the rationale for discounting money may not appear to apply to health" (p. 34).

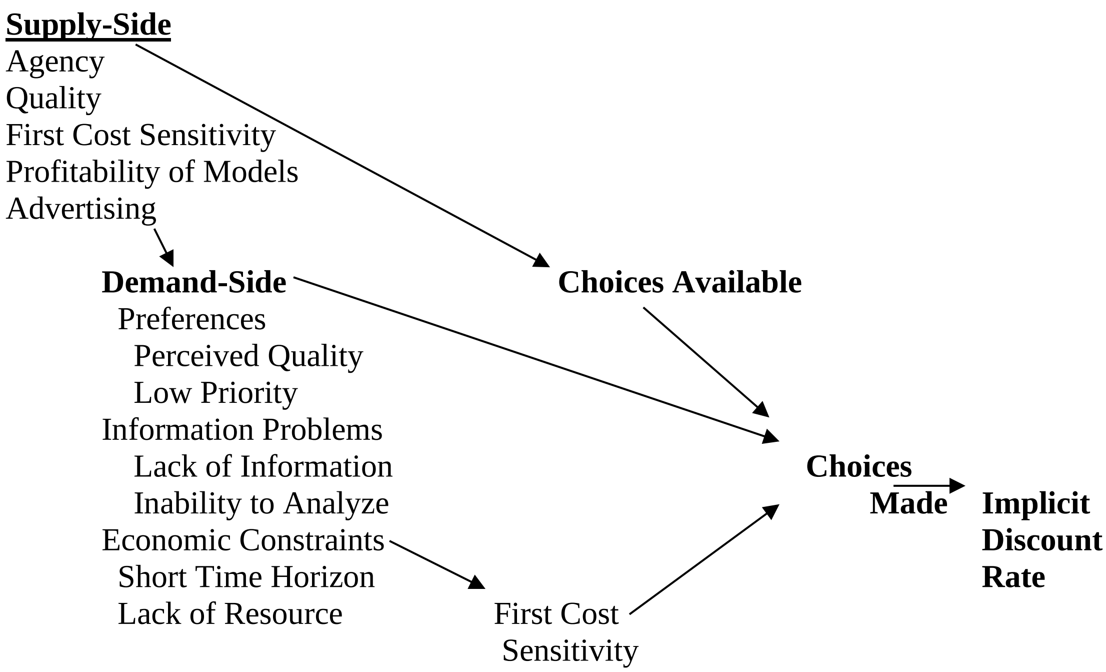
[48] Grayer, Ted and W. Kip Viscusi, 2012, *Overriding Consumer Preferences with Energy Regulation*, Mercatus Center.

wrong to apply a lower discount rate to justify policy, which implies an economic loss from failing to adopt an energy-saving technology to justify policy.

We believe this is wrong on several counts. First, the outcome in the market is not simply the result of consumer preferences, it is the result of all the forces that affect the options presented to consumers and that weigh on and constrain their choices. Manufacturers determine a narrow range of choices to present consumers and seek to influence consumers, through advertising and incentives, to purchase the vehicles that manufacturers want to sell. Consumer are imperfect in their calculations and projections about fuel usage and prices. Market imperfections matter and cannot be dismissed. Second, consumers do express a great deal of interest in and concern about energy usage. Third, more importantly, as noted, once a well-crafted standard is adopted and implemented, it lowers the cost of consuming energy to achieve the same utility.

Thus, we interpret the high market discount rate differently (seen Figure 9). It is the result of the many barriers and imperfections that retard investment in efficiency-enhancing technology. These barriers inhibit the adoption of efficiency-enhancing technology, driving up the apparent discount rate.

FIGURE 9: MARKET IMPERFECTIONS CREATE THE HIGH IMPLICIT DISCOUNT RATE



Source: Comments and Technical Appendices of the Consumer Federation of America, Re: National Highway Traffic Safety Administration Notice of Proposed Rulemaking; Docket No. NHTSA 2008-0089, RIN 2127-AK29; Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011-2015, July 1, 2008.

There are several aspects of the high discount rate that deserve separate attention. The empirical evidence on consumer rationality in the literature paints a picture that bears little resemblance to the rational maximizer of neoclassical, market-fundamentalist economics. We find a risk-averse, procrastinating consumer, who responds to average, not marginal prices. The consumer is heavily influenced by social pressures, with discount rates that vary depending on a number of factors, and has difficulty making calculations. To make matters more complicated, the consumer does not have control over key decisions. The decision of which energy consuming durable to purchase is made by someone else, like the landlord (i.e., the agency problem). Bundles of attributes are decided by producers in circumstances in which the consumer cannot disentangle attributes (the shrouded attributes problem.)

Consumers are influenced by advertising and may not perceive quality properly. The priorities afforded to any particular attribute are difficult to discern in a multi-attribute product. They lack the information necessary to make informed choices. The life cycle cost calculation is difficult, particularly when projections about future gasoline prices and vehicle use are necessary.

Even when they do consider efficiency investments, they may not find the more efficient vehicles to be available in the marketplace. Thus, we do not accept the claim that consumers are expressing irrational preferences for high returns on efficiency investments; irrational because they appear to be a return that is so much higher than they can get on other investments they routinely have available. Rather, we view the implicit discount rate as a reflection of the fact that the marketplace has offered an inadequate range of options to consumers who are ill-informed and unprepared to conduct the appropriate analysis and who lack the resources necessary to take the correct actions.

Firms suffer similar problems. We find organizational structure matters a great deal in routine-bound, resource-strapped organizations confronted with conflicting incentives and a great deal of uncertainty about market formation for new technologies. Knowledge and skill to implement new technologies are lacking and firms have little incentive to create it because of the difficulty of capturing the full value. Public policy efforts to address these problems have been weak and inconsistent. The supply-side does not escape these factors, and it exhibits the added problem of powerful vested interests and institutional structures that are resistant, if not adverse to change.

The energy-consuming durables that are sold in the marketplace reflect not only what consumers want to but also, what automakers want to sell. Automakers spend millions on advertising and promotions to move the metal that makes the most profit for them. It is simply wrong to claim that all the advertising and marketing have no effect (see Figure 9).

Failing to recognize the imperfections on the supply-side leads to an over-reliance on automaker product plans. Thus, it is a much better representation of reality to say that the producers in the market under values fuel economy. The problem is not just the consumer. Producers prefer to sell certain models because they are more profitable. They prefer simple technologies that are less demanding to produce and maintain. They have a first-cost bias, seeking to keep the sticker price low. They seek to influence the public to purchase the vehicles that best suit their interests.

On the supply-side, there is an agency problem – a separation between the builder or purchaser of buildings and appliances and the user. Suppliers may not choose to manufacture or stock efficient vehicles if they are less profitable, hoping that advertising and showroom persuasion can point consumers in the direction the manufacturers want them to go. The apparently grossly irrational discount rate reflects market imperfections and failures, not irrational consumers, a conclusion that has been clear throughout the long history of the efficiency gap debate.

The implicit discount rates calculated from consumer choices reflect not only individual time preferences but a whole collection of variables that may depress the ultimate level of investment. The calculated discount rate is affected by consumers' price expectations and their levels of certainty about these; the extent to which available information is imperfect, mistrusted, or ignored; the purchase of some equipment to quickly replace nonfunctioning equipment rather than to minimize life-cycle cost; the presence in the market of builders, landlords, and other purchasers who will not pay for the energy the equipment uses; the fact that consumers with limited capital do not always purchase what they would if they had more capital; differential marketing efforts for different products, and so forth. Recognizing such possibilities, some analysts say that the data reflect "market discount rates."[49]

This observation on the market discount rate, combined with the recognition that a 3% discount rate is a good estimate for the consumer discount rate, provides a realistic framework for understanding consumer discount rates and applying them in economic analyses. We applaud the agencies for arriving at this view and encourage them to affirm both in the final rule so that future rule makings can be grounded on this solid basis.

[49] Stern Paul C., "Blind Spots in Policy Analysis: What Economics Does Not Say about Energy Use," *Journal of* Policy Analysis and Management,"5:2 (1986), p. 209.

III. EVALUATION OF PROPOSED RULES FOR REFRIGERATORS AND CLOTHES WASHERS

Table 7 presents the evaluation of ten product classes of refrigerators and two product classes of clothes washers. Three categories of clothes washer, Semi-automatic, top-loading ultra-compacts and front-loading ultra-compacts are not included because they constitute and extremely small share of the market (less than 4%) and an even smaller share of energy consumption (less than 3%). The small number of criteria that are reports suggest that standards could be set at a much higher level. We have included the "All" evaluations to put the evaluation of the individual product classes into perspective.

A. REFRIGERATORS

In this discussion, we focus on the first five product classes of free-standing refrigerators and freezers, rather than built-ins. They account for over 90% of the energy savings from the proposed rule and 100% of the savings resulting from the "Plus 1" scenario. They also account for xx% of the market.

The table shows that all two dozen plus characteristics as we have defined them support the Plus 1" efficiency level for the major categories of refrigerators. They are technically feasible in the sense that the required technology is well below the maximum technology level. All are below max-tech, and they require, on average, less than 60% of maximum technology. The other product categories are probably inframarginal as well because the identified technologies are in use for other products, but no percentage is given.

They all save more energy, and as a consequence, the externalities that should be attributed to consumers using these products is large, but the DOE evaluation does not do so. In the evaluation of the standards and the "plus 1" scenario, we do so in calculating total benefits, assuming the national average ratio of external benefits to pocketbook savings at the national average rate.

The energy savings calculated in Table 7 is the total energy savings from the "Plus 1" scenario. We present this total figure since we are leery of the use of marginal values, as discussed above. Thus, we show the net pocketbook savings as a percent of life cycle cost (LCC) followed by the total savings when externalities are included. The Benefit/Cost ratios are substantially large than one and, in most cases, close to 2. The aggregate sensitivity analyses are all larger than 2. As shown in the Table in the aggregate consumer surplus analyses and the B/C ratio calculation PC 11 if slightly negative.

In the payback analysis, all of the payback periods of the pocketbook analysis are less than half the life of the appliance, and with the total benefit, they are about one-third of the life of the appliance.

In addressing the industry impacts, we have assumed the industry suffers all three effect, NPV loss, free Cas flow, and conversion costs, although it is high likely that there are overlaps between the three. Nevertheless, the economic costs, as less than 10% of the consumer gains. The employment impact is unclear (every estimate has a potential gain as well as a loss). These estimates are consistent with the earlier analysis. There is a very large loss of potential consumer surplus to prevent a small loss of producer surplus.

The employment impact is unclear (every estimate is less than 10% of the consumer gains. These estimates are consistent with the earlier analysis. There is a very large loss of potential consumer surplus to prevent a small loss of producer surplus.

We say that the employment impacts are uncertain because they include both a loss and gain in jobs. Even within the industry, jobs might be created by the need to adopt new technology. The indirect addition of jobs through the economic multiplier effect would reduce any reduction in employment within the industry. Given the above analysis, it is possible that more than half the lost jobs would be offset by increases in jobs elsewhere. Moreover, this is at best a transitory impact as the industry would quickly return to an equilibrium level. Given the competitive nature of the industry and the inelasticity of demand, there is no reason to believe that the equilibrium will involve less employment

The impact on low-income households also reinforces the earlier analysis. They have higher benefits of the three of the economic measures. They are not likely to have any negative effects. This reflects the fact that operative costs are likely to be a larger part of their expenditures and they are not likely to be responsible for the utility bills.

There is one caveat in the analysis. Although all of the large product classes indicate an increase in level is supportable, only PC 7 involves a large contribution to energy savings. At the same time, a reduction in the efficiency level would sharply reduce the energy savings in PC 3 and PC 5. Lowering the standard for these two product classes would reduce the energy savings by 18%. While other factors are clearly influencing decisions. The proposed levels appear to be a compromise. In the conclusion, we will consider higher levels of energy savings.

B. Clothes Washers

Table x shows that all two dozen plus characteristics as we have defined them support the Plus 1" efficiency level for clothes washers. They are technically feasible in the sense that the required technology is well below the maximum technology level. All are below max-tech and they require, on average, less than 60% of maximum technology. The other product categories are probably inframarginal as well because the identified technologies are in use for other products, but no percentage is given. Judging from the potential max-tech energy savings discussed below clothes washers are closer to max-tech, but they have not exhausted it.

In the "plus 1" scenario they save more energy, and as a consequence, the externalities that should be attributed to consumers using these products are large, but the DOE evaluation does not do so. In the evaluation of the standards and the "plus 1" scenario, we do so in calculating total benefits, assuming the national average ratio of external benefits to pocketbook savings at the national average rate.

The energy savings calculated in Table 7 is the total energy savings from the "Plus 1" scenario. We present this total figure since we are leery of the use of marginal values, as discussed above. Thus, we show the net pocketbook savings as a percent of life cycle cost (LCC) followed by the total savings when externalities are included. The Benefit/Cost ratios are larger than one and in case of front loaders greater than 2. Adding in the externalities increased the B/C ratio even more. The sensitivity cases all involved a B/C ratio of close to 2 or more.

TABLE 7: EVALUATION OF PROPOSED RULE: EFFICIENCY LEVEL PLUS 1

	Refrigerators												Standard Clothes Washers		
	All	PC 3	PC 5	PC 5B	PC 5A	PC 7	PC 9	PC 10	PC 11 R	PC 11 C	PC 17	PC 18	All	Top	Front
Efficiency Levels		3 to 4	2 to 3	3 to 4	3 to 4	4 to 5	1 to 2	?	2 to 3	2 to 3	1 to 2	2 to 3		3 to 4	3 to 4
Criteria															
Technically feasible		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
% of Max Tech or		40	50-71	43 - 90	42	75	38				50	Y			
or infra marginal tech							Y	Y	Y		Y			Y	Y
Saves more energy		5%	5%	5%	6%	3%	5%	10%	10%	12%	5%	10			
Climate & public health		n	n	n	n	n	n	n	n	n	n	n		n	n
Extern % of net pocketbook			52,2%	52,2%	52,2%	52,2%	52,2%	52,2%	52,2%	52,2%	52,2%	52,2%	52,2%		
	50.1	50.1													
Energy Saving (all) (%)		57%	10%	10%	0%	31%	0%	0%	54%	54%	46%	46%		12%	18%
Economically Justified															
LCC % change															
Pocketbook		13.7	12.7	8.4	14.7	15.8	7.2	5.2	16.9	14.6	12.2	16.1		15.7	5
Total		21	19	13	22	24	11	8	26	22	19	24		24	8
Saving as % of LCC															
		2.60	1.90	1.20	1.20	3.80	3.80	1.10	3.80	0.10	2.00	2.70		6.40	4.40
		1.60	1.60	1.30	1.30	3.40	3.40	0.00	1.10	0.12	1.30	1.50		7.50	5.90
Pocketbook B/C > 1		1.3	1.33	1.03	1.6	1.12	1.554	1.45	n (.1)	n (-1.5)	1.06	1.26		1.09	2.43
Primary		2.66													
Low		2.25													
High		2.88													
Consumer surplus		1540	47.9	15.4	121.98	94.68	55.78	10.2	n (=9.1)	n (-159)	2.41	8.76		23	44
Payback % of Appl Life															
Net Pocketbook		35.18	47.3	32.43	28.39	34.39	18.33	52.49	27.77	41.56	47.62	39.62		43	22
Total		23.14	31.12	21.34	18.68	22.63	12.06	34.53	18.27	27.34	31.33	26.07		28.7	15.3
% neg, impact															
Base %		36.2	23.4	10.4	16.6	28.5	10.8	0	8.3	0	12.3	21.6		35	24
% point Incr.		23.5	29.4	35.3	16.6	7.2	30.2	62.7	10.9	17.2	39.8	29.4		-2	-6
Total %		59.7	52.8	45.7	33.2	35.7	41	62.7	19.2	17.2	52.1	51		23	18
incr. free cash v.															
dec consumer surplus															
Low Inco															
LCC Savings		+	+	+	+	+	+	+	+	+	+	+		+	+
Payback Period		-	-	-	-	-	-	-	-	-	-	-		-	-
% Negative		-	-	-	-	-	-	-	-	-	-	-		-	=

Notes: DOE calculates the overall average for a number of the items listed in Table 2. Where these were not provided, we have used the simple average of the classes of products. Only the standard washers are included, since they account for about 96% of the market. The simple average is used to be consistent with the refrigerator analysis, which is much more evenly spread across classes.

Sources: See Table 3

In the payback analysis, all of the payback periods of the pocketbook analysis are fairly quick, considerably less than half the life of the appliance. With the total benefit, they are about one-third of the life of the appliance.

In addressing the industry impacts, we have assumed the industry suffers all three effect, NPV loss, free Cas flow and conversion costs, although it is high likely that there is overlaps between the three. In the clothes washer analysis, the economic costs, as less than 10% of the consumer gains. The employment impact is unclear (every estimate is less than 10% of the consumer gains. These estimates are consistent with the earlier analysis. There is a very large loss of potential consumer surplus to prevent a small loss of producer surplus.

We say that the employment impacts are uncertain because they include both a loss and gain in jobs. Even within the industry, jobs might be created by the need to adopt new technology. The indirect addition of jobs through the economic multiplier effect would reduce any reduction in employment within the industry. Given the above analysis, it is possible that more than half the lost jobs would be offset by increases in jobs elsewhere. Moreover, this is at best a transitory impact as the industry would quickly return to an equilibrium level. Given the competitive nature of the industry and the inelasticity of demand, there is no reason to believe that the equilibrium will involve less employment

The impact on low-income households also reinforces the earlier analysis. They have higher benefits of the three of the economic measures. They are not likely to have any negative effects. This reflects the fact that operative costs are likely to be a larger part of their expenditures and they are not likely to be responsible for the utility bills.

There is one caveat in the analysis. Although all of the large product classes indicate an increase in level is supportable, only PC 7 involves a large contribution to energy savings. At the same time, a reduction in the efficiency level would sharply reduce the energy savings in PC 3 and PC 5. Lowering the standard for these two product classes would reduce the energy savings by 18%. While other factors are clearly influencing decisions. The proposed levels appear to be a compromise. In the conclusion, we will consider higher levels of energy savings.

C. CONCLUSION

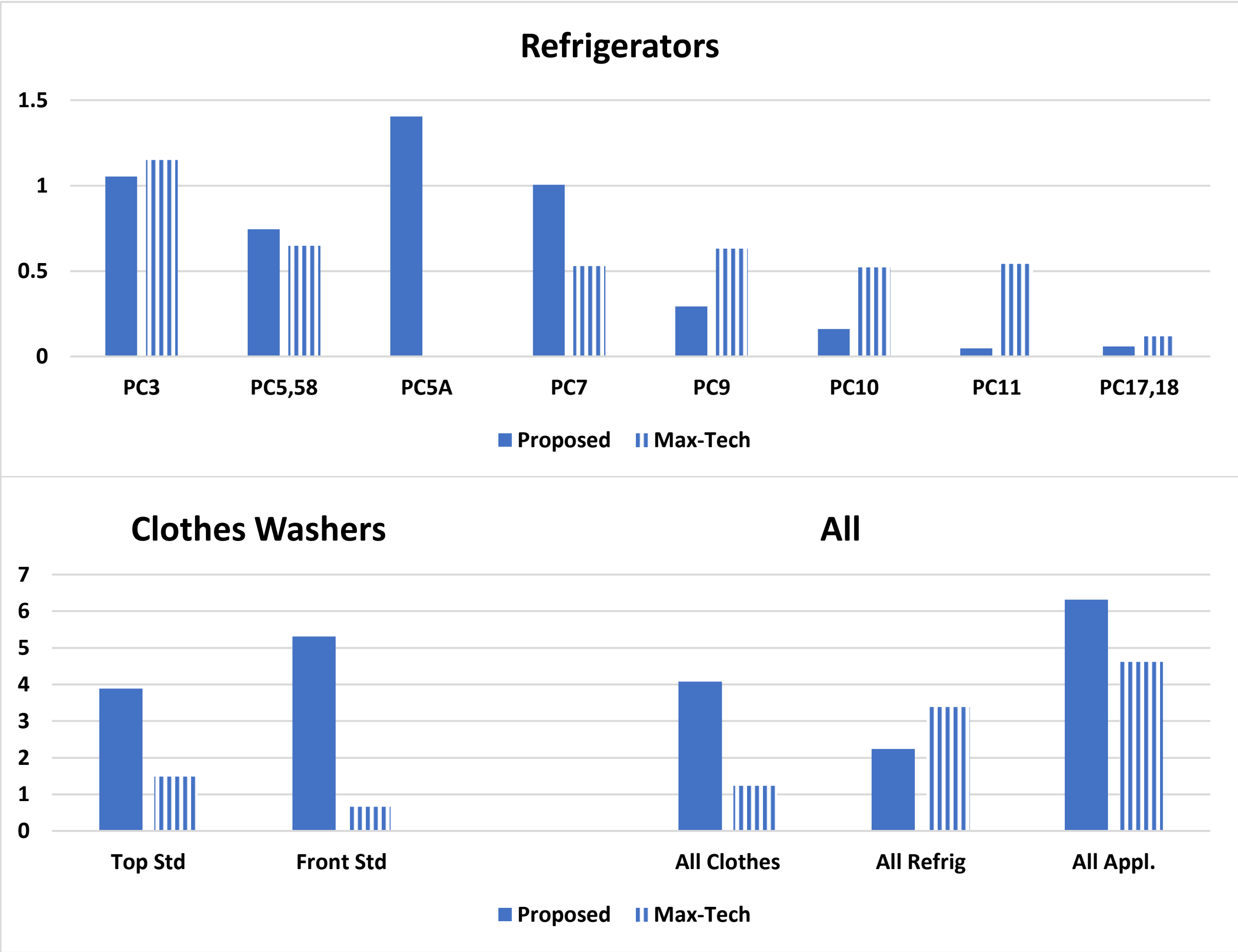
In the body of the analysis, we have shown that increasing the efficiency level by one step is supported by over two dozen criteria, with the one exception. DOE has given weight to the impact on the industry and the significance of energy savings in arriving at the proposed level. By showing that it could move up one level and still meet the criteria, we have outlined. We have placed its proposal in perspective and made a case against lowering the proposed standards. In this conclusion, we briefly introduce another perspective and (perhaps) an agenda for the future, since the agency is required to review its past decision on a regular basis.

DOE's mandate is to achieve **maximum** energy savings, subject to constraints. It has dealt with the technological availability constraint by asserting that it has initially considered only technologies that are already being used in the marketplace (and therefore at technically feasible). On that basis, it has calculated and presented the results from a max-tech thresholds. Of course, technical availability does not answer all questions about the ability of the industry to adopt every technology, and it has expressed strong reservations about using some technology options in some products.

Over time, as the industry uses its freedom to meet the current standards, technologies will become easier to implement, and new technologies will enter the marketplace so that today's max-tech will become easier to implement and the frontier might move out substantially. Thus, max-tech may point the way to the future.

Figure 10 shows that this is an important consideration that DOE should take into account as it moves forward. The figure shows that max-tech achieves much higher energy savings than the proposed standards. In the aggregate, energy saving could be increased by two-thirds at max-tech. About two-thirds coming from refrigerators, dominated by the same four product classes on which we have focused the analysis. Although the clothes washers can achieve less, we have already seen that they could easily have been advanced to the next level.

FIGURE 10: PROPOSED V. MAX-TECH ENERGY SAVINGS



Sources: Refrigerators, Fed. Reg. Notice, Table V.30, Clothes Washers, weighted Average of Fed. Reg. Notice, T. V.1

A brief examination of the basic consumer economics of the max-tech scenario supports this conclusion; see Table 8. The LCC savings is positive for the product class 3 through 10, and both categories of clothes washers. The benefit/cost ratio based on the pocketbook is greater than one, based on pocketbook only. It is much larger based on total benefits. Even the product classes with a slight negative on pocketbook benefits are likely to be positive based on total benefits. Payback periods are less than half than the life of the appliance, except for PC 3, where it is less than 60% and the product classes that have a negative LCC saving, which are 75% or more. The percentage with a negative impact from the max-tech standard is higher, with several above 50%. This is high enough to cause concern in some cases. Over time, as costs come down these concerns may be alleviated.

TABLE 8: EVALUATING PLUS 2 STANDARDS

	Refrigerators								Clothes Washers	
Class	PC3	PC5,58	PC5A	PC7	PC9	PC10	PC11	PC17,18	Top Std	Front Std
% LCC savings	0.4	0.6	3.6	3.4	3.9	2.3	n	n	7.5	5.9
B/C ratio										
Pocketbook	1.12	1.31	1.84	1.85	1.53	3.96	n	n	1.15	3.86
Total	1.7	1.99	2.8	2.8	2.3	6.02	+	+	1.7	5.0
Payback Yrs/ Appl Life (%)										
Pocketbook	59	51	39	39	44	49	93	76	40	24
Total	39	20	25	25	29	32	61	50	27	16
% neg impact	64	51	33	36	51	52	62	68	23	18

Sources: Fed. Reg. Refrigerators, Tables v,3-24, V.30; Fed. Reg. Clothes Washers, Tables v.8,9,12,13,16,18.