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PUBLIC INTEREST COMMENT

THE DOE SHOULD CLARIFY MODEL UNCERTAINTY AND STRENGTHEN COST AND BENEFIT COMPARISONS IN ITS ANALYSES

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The National Academies of Sciences, Engineering, and Medicine have organized a committee to peer-review the analytical methods used by the US Department of Energy (DOE) in setting "standards regulations" for the performance of buildings and associated equipment and products. This short comment makes recommendations to the committee about ways in which DOE technical support documents (TSDs) can be improved.

By way of background, I am a senior research fellow at the Mercatus Center at George Mason University, as well as an adjunct professor at Antonin Scalia Law School. Relevant to this committee, I am also a special government employee serving on the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) for the DOE, and I recently served as the consumer representative on a working group to negotiate an energy efficiency standard for variable refrigerant flow multi-split air conditioners and heat pumps.

Based on my experience working on energy efficiency standards, I have two main recommendations to make to the committee.

First, the DOE should clarify issues of model uncertainty in its analysis. Currently, it seems to justify many standards, explicitly or implicitly, on a "behavioral economics" model of consumer behavior. Such a model would suggest that reduced consumer choice can bestow a benefit upon consumers. The mainstream model underlying cost-benefit analysis (CBA), however, is the neoclassical model, which sees expanded consumer choice as a good thing. According to that model, reduced choice would generally constitute a cost to consumers, absent some significant market failure. The choice of which model to use has most direct relevance to the national impact analysis and estimation of payback periods in DOE TSDs.

Second, DOE TSDs include many "apples and oranges" problems. In other words, benefits and costs that are not directly comparable to one another are being added together inappropriately.

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DOE should carefully distinguish those benefits and costs that come in the form of investment, such as some compliance costs or operating cost savings, from those that come in the form of consumption, such as the benefits associated with reducing carbon dioxide emissions.

MODELING UNCERTAINTY: BEHAVIORAL ECONOMICS OR THE NEOCLASSICAL MODEL?

A core assumption in "neoclassical," or simply mainstream, economics is that consumers and businesses act rationally. That is, people act in a manner consistent with their own self-interest, and they make the most of the scarce resources available to them. This assumption is not so much a strict statement about how particular individuals behave, as an assumption that is useful for making predictions as to how groups will behave or how real-world markets will evolve over time.[1]

An implication of the rationality assumption is that an analyst can infer something about people's preferences by looking at their behavior. In economics parlance, this is called "revealed preference." For example, if a consumer opts to buy a certain piece of equipment (such as a computer or an oven), the analyst assumes the purchase made the consumer better off. So long as consumers are reasonably informed, the behavior suggests they value the equipment more than the money they gave up purchasing it and more than any alternative products they could have bought using the same resources.

In recent decades, "behavioral economics" has risen to challenge certain aspects of the neoclassical model. Behavioral economists have identified numerous biases that can lead to suboptimal, irrational decision-making.[2] Unlike neoclassical economists, who often believe that through learning and repeated experiences in the marketplace, systematically irrational behavior will be eliminated, behavioral economists believe suboptimal decisions can occur quite systematically. Behavioral economists do not think analysts can always infer consumer preferences from behavior. Instead, they believe that consumers often act in a manner that is not consistent with their own well-being.

Historically, CBA has relied on the neoclassical model, not the behavioral model. CBA, for example, often relies on estimates of consumer willingness to pay from observed behavior to value various benefits and costs of government programs. Discarding the traditional assumption of consumer rationality would be a departure from normal CBA practices, and it would also mean that all benefit and cost estimates derived from market exchanges would be of questionable value. Even if one believes that there is evidence that consumers consistently behave irrationally in particular markets, such as energy markets, there is no consensus among economists as to how to incorporate behavioral findings into CBA, nor as to what would replace benefit and cost valuations that are currently based on revealed preferences.

Furthermore, there is no consensus as to the extent of behavioral bias in energy markets. The empirical evidence on the existence of an "energy efficiency gap"—a problem whereby

[1] Milton Friedman famously argued that billiards players act as if they know complex mathematical formulas. Thus, an analyst might be able to predict their behavior with mathematics, even though billiards players do not think in terms of math, generally. The usefulness of a model, according to Friedman, is not in the realism of its assumptions but in its ability to make predictions. This is relevant to behavioral economics and to social psychology more generally, which has not demonstrated its predictive power yet and has at times been claimed to suffer from a "replicability crisis." Milton Friedman, "The Methodology of Positive Economics," in *Essays In Positive Economics* (Chicago: University of Chicago Press, 1953), 3–43; Alison McCook, "'I Placed Too Much Faith in Underpowered Studies:' Nobel Prize Winner Admits Mistakes," *Retraction Watch*, February 20, 2017.
[2] For a list of behavioral biases, see Buster Benson, "Cognitive Bias Cheat Sheet," *Better Humans*, *Medium*, September 1, 2016.

consumers seem to undervalue future energy savings—is actually somewhat mixed. Economists Hunt Allcott and Michael Greenstone reviewed the large literature on the energy efficiency gap, concluding that there is far less support for it than is commonly asserted.[3] More recently, economists Kenneth Gillingham and Karen Palmer offered a variety of reasons why the energy efficiency gap is likely to be overestimated, though they believed behavioral failures could be important in some targeted cases.[4]

This uncertainty has not stopped the DOE from incorporating behavioral assumptions, explicitly,[5] or perhaps more often implicitly, into two areas of its TSDs: the national impact analysis and the analysis of payback periods.

With respect to the national impact analysis, the starting point, or baseline, should be consumer behavior in the absence of a regulation. Under that setting, some consumers in the marketplace would opt to purchase devices that are less energy efficient. When these products are subsequently banned by regulators, these consumers must purchase either a more efficient device or no device at all. If consumers are broadly acting in their own self-interest, removing the option to purchase less-energy-efficient products represents an unambiguous cost to them. Furthermore, these consumers are not paid back for their loss.

It is possible that neoclassical market failures could be present in some energy markets, for example, owing to divergent incentives between renters and owners of homes or buildings or owing to consumers having insufficient information about the benefits of energy efficiency. However, such a market failure would have to be clearly established in each individual instance before a regulatory intervention would be justified. Furthermore, the nature of the problem at hand should help shape the design of the solution. Instead, the DOE often presents a laundry list of potential problems that might exist in energy markets,[6] as if it is offering any potential justification it can find for its regulations. And yet the solution is always the same: ban energy-inefficient devices.

Whatever the rationale, the DOE's analysis appears to treat this restriction of choice as a benefit to consumers.[7]

The DOE seems to be assuming consumers are irrational or not otherwise capable of making informed purchasing decisions when they buy less-energy-efficient products. Its TSDs tally up operating cost savings and count this as a benefit, while ignoring any other factors, aside from energy savings, that may have led consumers to choose less-energy-efficient devices. Marketing materials from the DOE also tout significant "consumer benefits,"[8] but if there is no market failure present, these regulations instead impose costs on consumers, not benefits.

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[3] Hunt Allcott and Michael Greenstone, "Is There an Energy Efficiency Gap?," *Journal of Economic Perspectives* 26, no. 1 (2012): 3–28.
[4] Kenneth Gillingham and Karen Palmer, "Bridging the Energy Efficiency Gap: Policy Insights from Economic Theory and Empirical Evidence," *Review of Environmental Economics and Policy* 8, no. 1 (2014): 18–38.
[5] For explicit examples, see Ted Gayer and W. Kip Viscusi, "Overriding Consumer Preferences with Energy Regulations," *Journal of Regulatory Economics* 43, no. 3 (2013): 248–64; Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers, 77 Fed. Reg. 32308, 32370 (May 31, 2012).
[6] Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers, 77 Fed. Reg. 32308, 32370 (May 31, 2012).
[7] James Broughel, "Are You Too Irrational to Choose the Right Appliance? The Department of Energy Thinks So," Mercatus Center at George Mason University, September 11, 2013.
[8] US Department of Energy, *Saving Energy and Money with Appliance and Equipment Standards in the United States*, January 2017.

Recommendation 1: The DOE should calculate any costs to consumers from removing items from the marketplace that they would otherwise purchase. If the DOE continues to calculate operating cost savings and count them as benefits in analysis, it should defend those savings on the existence of a market failure, it should provide evidence the market failure is real and systemic, and it should explain why its proposed solution is the best available option to address the problem.

Use of neoclassical assumptions should extend to the analysis of payback periods. In this analysis, the DOE calculates a weighted average cost of capital for businesses and consumers in order to discount future energy savings to present value, and by extension to determine the payback period after which consumers are compensated for the higher up-front purchase price of regulated products.

Economists who believe in revealed preference would generally assume that consumers and businesses are best situated to make decisions for themselves about the relative tradeoffs between higher up-front costs and future streams of savings. In other words, whatever discount rate consumers or businesses use is the rate that is appropriate for their unique circumstances. The DOE should not substitute a discount rate of its own choosing for the rate consumers have used in their decision-making process. The DOE is unlikely to have the information necessary to determine all of the relevant tradeoffs and financial constraints facing consumers. Higher-priced energy-efficient devices, even if they are more cost-effective over time, may not be the most rational purchase for consumers who are not able to borrow in a time of cash shortage. In fact, the Consumer Financial Protection Bureau reported in 2015 that 26 million Americans, or roughly 1 in 10 adults, have no credit history.[9] This practice of substituting the DOE's discount rates for private citizens' discount rates is all the more unreasonable when purchasers of equipment are businesses, who presumably can determine their own weighted average cost of capital without help from regulators.[10]

Recommendation 2: The DOE should calculate payback periods under the assumption of revealed preference, such that the discount rates implicit in consumer and business actions are appropriate for their personal situations.

COMPARING APPLES AND ORANGES: CONFLATING CONSUMPTION AND INVESTMENT BENEFITS AND COSTS

The DOE's benefits analyses in its TSDs usually document a variety of benefits emanating from its standards rules. These benefits broadly include things like operating cost savings from reduced

[9] Consumer Financial Protection Bureau, "CFPB Report Finds 26 Million Consumers Are Credit Invisible," press release, May 5, 2015, https://www.consumerfinance.gov/about-us/newsroom/cfpb-report-finds-26-million-consumers-are-credit-invisible/.
[10] This is relevant to the particular working group I was recently involved in, which related to commercial heating and air conditioning equipment.

energy use and environmental benefits that come in the form of reduced CO_2 emissions and other pollutants, such as NOx emissions.

The benefits from reduced CO_2 emissions are calculated using the "social cost of carbon" (SCC), which is an estimate of the monetized damages from emitting an additional ton of CO_2 into the atmosphere. The models underlying the government's SCC estimate express the SCC in "consumption-equivalent" form,[11] reflecting the effect of climate change on future consumption. It is simply inappropriate to add together consumption-related benefits like these to operating cost savings, because some fraction of the latter will be invested and grow in value in the future, or to subtract from these consumption benefits compliance costs, some fraction of which will constitute displaced investment.

An example may make this clearer: Let's say a regulation generates $1 billion in operating cost savings, generates $500 million in reduced losses to consumption as a result of mitigating climate change, and costs $1.25 billion in compliance. Can these numbers simply be added together? The public won't spend all of the saved money from reduced energy use on additional consumption. Rather, some fraction of the funds will go toward capital investment and will hence grow in value in the future. Similarly, some of the financial costs imposed by regulations would have gone toward capital investment in absence of a regulation. These benefits and costs will evolve very differently from the fleeting, one-time consumption benefits from reduced CO_2 emissions.

The critical information the DOE needs to make a decision about whether the regulation should proceed is how much investment is created by the operating costs savings, how much is displaced by the compliance costs, and what the relevant rates of return on these benefits and costs would be. In fact, if the DOE simply were to assume that the same fraction of financial costs and benefits constitutes investment on each side of the ledger and that all investment would earn the marginal rate of return to capital in the economy,[12] then the SCC benefits are completely irrelevant from an economic efficiency perspective. The one-time impacts would not grow at compounding rates like the investment benefits and costs.[13] Thus, all the agency would need to do is find the net present value of financial costs and benefits.

However, the DOE makes no distinction between capital investment and consumption. It simply adds everything together, in essence giving consumption and investment equal weight in analysis (or assuming no impact on investment from its rules). This downplays any effect regulations have on investment and gives too much relative weight to consumption. This is not to say that the SCC benefits are unimportant, just that they should probably be considered in some other venue than the analysis of economic efficiency.

[11] Richard Newell, "Unpacking the Administration's Revised Social Cost of Carbon," *Resources*, October 10, 2017; William D. Nordhaus, "Revisiting the Social Cost of Carbon," *Proceedings of the National Academy of Sciences* 114, no. 7 (2017): 1518–23.
[12] The Office of Management and Budget assumes this rate is 7 percent. Office of Management and Budget, *Circular A-4*, 2003.
[13] On the differences between one-time, ongoing, and compounding benefits and costs, see James Broughel, *Regulation & Economic Growth: Applying Economic Theory to Public Policy* (Arlington, VA: Mercatus Center at George Mason University, 2017); Tyler Cowen, "Caring about the Distant Future: Why It Matters and What it Means," *University of Chicago Law Review* 74, no. 5 (2007): 5–40.

Recommendation 3: The DOE should distinguish between benefits and costs that come in the form of consumption and those that come in the form of investment, and it should distinguish one-time impacts from benefits and costs that are growing at compounding rates.

CONCLUSION

The behavioral model sometimes relied on by the DOE to estimate operating cost savings and payback periods is out of the mainstream. While behavioral economics could certainly end up playing a more prominent role in future regulatory analysis, until there is consensus about what this role should look like, the DOE should continue to rely on the neoclassical model, which underlies cost-benefit analysis in virtually every other context. If it continues to count operating cost savings as a benefit of its regulations, it should justify them on the basis of a neoclassical market failure, providing relevant evidence to back up its claims, and demonstrating that the solution it proposes is tailored to the specific problem it is addressing.

Furthermore, the net benefit estimates in the DOE's analyses are often incoherent. The agency seems to be acting under the assumption that no investment is created or displaced as a result of its regulations, which is a somewhat extreme position. The DOE should carefully distinguish those benefits and costs that come in the form of investment from those that come in the form of consumption.

This committee has an opportunity to help the DOE correct these deficiencies. I hope that these comments are useful to you. Please reach out with any questions.