

Cash for Clunky Appliances

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Introduction

The federal government's Car Allowance Rebate System (CARS), or "Cash for Clunkers," was a remarkable and unpredicted success. At the close of the program on August 25, 2009, U.S. Transportation Secretary Ray LaHood declared that the "wildly successful" program was "one of the best economic news stories we've seen," referring to the program's positive effects on manufacturing, economic growth, job creation, and the environment.¹

The success of the Cash for Clunkers program may be attributed to the combination of several characteristics. First, the program provided real financial incentives to consumers – offering a \$3500 or \$4500 discount on the purchase or lease of a new vehicle when trading in an old one.² The secondary financial savings to consumers in the form of reduced spending on gasoline due to greater fuel efficiency were equally apparent. Second, the behavioral insight of the program's design was significant. Consumers were smitten with the idea of "unloading a burdensome possession and getting something new in return."³ By requiring trade-ins and environmentally-beneficial upgrades, the program relieved some consumers from the "guilt of conspicuous consumption,"⁴ and appeased those seeking to avoid "overconsumption" and instead "[p]ractice sufficiency."⁵ Third, the program was convenient and streamlined – for consumers, the bulk of the deal was accomplished in one transaction. Finally, Cash for Clunkers was well-publicized – information was readily available and comprehensible to all.

To be sure, Cash for Clunkers garnered significant criticism as well, questioning in particular the program's cost-effectiveness and environmental achievements. The analysis below addresses these concerns and demonstrates why they should not impede efforts to use the Cash for Clunkers model in other contexts.⁶

Thus, the possibility of replicating this programmatic model for different ends is clearly appealing. This paper examines the viability of a "Cash for Appliances" ("CfA")

¹ Press Release, U.S. Department of Transportation, Cash for Clunkers wraps up with nearly 700,000 car sales and increased fuel efficiency, U.S. Transportation Secretary LaHood declares program "wildly successful" (Aug. 26, 2009), available at <http://www.cars.gov/>.

² Press Release, U.S. Department of Transportation, Transportation Secretary Ray LaHood Kicks-Off CARS Program, Encourages Consumers to Buy More Fuel Efficient Cars and Trucks (July 27, 2009), available at <http://www.cars.gov/>.

³ Julie Scelfo, *Old Sofas Borrow a New Idea from Cars*, N.Y. Times, Sept. 30, 2009, available at <http://www.nytimes.com/2009/09/24/garden/24clunkers.html?scp=1&sq=old%20sofas%20borrow&st=cse>.

⁴ Id.

⁵ James Gustave Speth, *The Bridge at the End of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability* 163 (2008).

⁶ See *infra* Part I.3.

program that targets home appliances toward the goal of increasing energy efficiency and decreasing greenhouse gas (“GHG”) emissions. Analyzing an existing CfA effort at the federal level, this paper argues that the case for a federal CfA program is strong, but that the current federal effort falls short of fulfilling its potential. The analysis proceeds in four parts. Part I makes the case for a Cash for Appliances program as a policy tool for promoting energy efficiency. Part II examines existing programs that have done just this – utilized the Cash for Clunkers model to stimulate consumer upgrades to more energy efficient appliances – including a program by the federal government. Part III examines the federal program more closely and identifies a number of defects in the current design. Part IV lays out suggestions for restructuring the federal program in future years to make it more efficient and effective.

Part I – The Case for a Cash for Appliances Program

The case for an aggressive government-led program to increase end-use efficiency in the residential sector is unequivocal and rooted in three compelling rationales: First, reductions in energy use would increase social welfare by contributing to climate change abatement, economic savings, national security efforts, and public health improvements. Second, residential efficiency improvements would likely not occur without significant government incentives. Third, Cash for Appliances is a cost-effective way to achieve efficiency gains and avoids the cost criticisms launched at the Cash for Clunkers program.

1. Social Welfare Gains

A. Climate Change

Greenhouse gas emissions from electricity consumption are significant.⁷ Electricity generation accounted for 40.6% of all energy-related Carbon Dioxide emissions in 2007, up from 36.2% in 1990.⁸ Residential end use accounts for 21% of energy-related CO₂ emissions, and greater use of home appliances and electronics has contributed significantly to the increase in electricity demand in recent years.⁹

The case for energy efficiency as a tool to address climate change is incontrovertible: energy efficiency measures are cost-effective and technologically available. Analyzing a scenario in which the U.S. reduces annual emissions of CO₂ equivalents by 3.0 gigatons by 2030, a McKinsey & Co. team concluded that “almost

⁷ This paper focuses primarily on electricity use as a source of GHG emissions since the majority of the appliances dealt with in this paper consume electricity.

⁸ Energy Information Administration, Emissions of Greenhouse Gases in the United States 2008, at 2 (Dec. 3, 2008), available at <http://www.eia.doe.gov/oiaf/1605/ggrpt/carbon.html>.

⁹ *Id.* at 16.

40% of abatement could be achieved at “negative” marginal costs.¹⁰ The “cluster of abatement potential” with the highest negative costs (i.e. those with highest cumulative savings over time) was energy efficiency in buildings and appliances.¹¹ Both the negative abatement costs and the ready availability of more efficient alternatives indicate that energy efficiency programs are indeed a species of low-hanging fruit for addressing climate change.

While this paper focuses primarily on climate change as the motivation for reducing electricity consumption, several other rationales – discussed below – are noteworthy.

B. Financial Incentives

The economic basis for curbing electricity use is compelling. As Amory Lovins consistently argues, saving energy (in the form of “negawatts”) will always be cheaper than buying it.¹² Furthermore, growth in peak demand for electricity due to burgeoning stocks of home appliances and electronics has increased substantially in the last thirty years and has surpassed transmission growth by approximately 25% each year since 1982.¹³ Increases in peak use require utilities to deploy expensive peak plants to meet demand, increasing costs of generation as fuel is purchased on the “more volatile ‘spot’ market.”¹⁴

C. National Security

National security interests require “reducing dependence on [energy] supply chains” through energy conservation and efficiency.¹⁵ Although only a small fraction – under 2% – of electricity is generated from petroleum,¹⁶ the potential for international conflict and terrorism to disrupt energy supply and distribution chains remains a compelling reason to invest in energy efficiency measures.¹⁷

¹⁰ McKinsey & Co. and The Conference Board, *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* xiii-xiv (Dec. 2007).

¹¹ *Id.*

¹² Amory B. Lovins, *More Profit with Less Carbon*, *Scientific American*, Sept. 2005, at 74.

¹³ The Smart Grid: An Introduction, *prepared for* U.S. Department of Energy by Litos Strategic Communication 6 (2008), available at <http://www.oe.energy.gov/SmartGridIntroduction.htm>.

¹⁴ *Id.* at 13-14.

¹⁵ John Dernbach, *Stabilizing and then Reducing U.S. Energy Consumption: Legal and Policy Tools for Efficiency and Conservation*, 37 *Envtl. L. Rep.* 10003, 10005 (Jan. 2007).

¹⁶ Energy Information Administration, *Electric Power Monthly* (Sept. 2009), available at http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html.

¹⁷ Dernbach, *supra* note 15, at 10005.

D. Public Health

A warming planet is likely to have significant consequences for health worldwide, including deaths and illness from thermal stress; food poisoning from microbial proliferation; greater instances of infectious disease; malnutrition from decreased agricultural production; and poverty, mental health, and physical risks from loss of livelihood and displacement.¹⁸ Furthermore, air pollutants from electricity generation damage health and contribute to lost school and work days and higher health costs.¹⁹

These rationales for efficiency measures are far from exhaustive; they merely provide a glimpse at the compelling evidence supporting energy efficiency measures.

2. Efficiency Improvements Will Remain Limited Without Government Involvement

A key impetus for a Cash for Appliances program is the idea that without financial incentives, people are unlikely to purchase a particular appliance simply because it is more energy efficient. Even when consumers are in the market for a new appliance, they harbor high “implicit discount rates” and tend to forgo more efficient and cost-effective products.²⁰ Scholars have termed this market failure the “efficiency gap: the difference between the level of energy efficiency actually achieved and the level judged cost-effective by standard financial criteria.”²¹

Explanations for consumer under-investment in energy conservation often attribute the phenomenon to the existence of several market barriers.²² First, imperfect information acts as a significant barrier to consumer uptake of energy efficient products. Consumers tend to lack information about the net energy and cost savings of appliances.²³ In fact, empirical studies of household views on energy use demonstrate that consumer “information is not only incomplete, but systematically incorrect.

¹⁸ Anthony J. McMichael, Rosalie E. Woodruff & Simon Hales, Climate Change and Human Health: Present and Future Risks, *The Lancet* 860 (Mar. 11-17, 2006).

¹⁹ Natural Resources Defense Council, Air Pollutants that Trigger Asthma (2005), available at <http://www.nrdc.org/health/effects/fasthma.asp>.

²⁰ Richard B. Howarth & Alan H. Sanstad, *Discount Rates and Energy Efficiency*, *Contemp. Econ. Pol’y*, July 1995, at 101.

²¹ Id. See also William H. Golove & Joseph H. Eto, *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency*, Energy & Environment Division, Lawrence Berkeley National Laboratory, at 6 (March 1996) (outlining development and parameters of term “efficiency gap”).

²² The existence and implications of the efficiency gap have generated a large and inconclusive debate in the literature. This paper makes no attempt to further this debate. Rather, this paper takes the position that the efficiency gap is real, and that the implications are significant and should be addressed in future policy measures. See, e.g., Golove & Eto, *supra* note 21, at 12 (reviewing five primary critiques of the “efficiency gap” theory and responses to these critiques).

²³ Howarth & Sanstad, *supra* note 20, at 106.

Generally speaking, people tend to overestimate the amounts of energy used by – and that may be saved in – technologies that are visible and that must be activated each time they are used. Thus, people overestimate energy use by televisions and lights and underestimate energy use by furnaces and water heaters.”²⁴

Second, markets for energy efficient products suffer from the “split incentive” problem, whereby one party pays the cost of investing in a certain technology and a different party reaps the benefits.²⁵

Third, consumers often lack the capital to invest in new technologies or to pay a premium for a more efficient appliance.²⁶

Fourth, appliance selection often occurs in the context of “rushed decisions.” When an appliance breaks, a consumer may be in such a hurry to get a new one that she forgoes research about efficiency in order to replace the appliance as quickly as possible.

Fifth, consumers may perceive investments in energy efficiency as inherently risky due to fluctuating fuel prices and rapid technological change, and thus avoid investments in this uncertain area.²⁷

Finally, “bounded rationality” inhibits effective choices about energy efficient products. Information about energy savings, even if available to consumers, may be sufficiently unfamiliar or complex. As a result, many of the “cognitively efficient rules of thumb [that consumers use] to render decisions,” may produce adverse results in an unfamiliar or complicated situation.²⁸ This paper asserts that overcoming these barriers should be an integral part of energy efficiency policies. Solutions to these barriers in the context of a Cash for Appliances program are developed in Part IV.2.

3. Cost-Effectiveness

Cash for Clunkers evoked substantial criticism about the program’s cost that potentially cuts against replicating the programmatic structure in the appliance context. The cost critique may be divided into two separate issues. First, some assert that the cash incentives were wasteful because the sales of cars would have occurred anyway.²⁹ Second, many argue that the program was not a cost efficient way to reduce GHGs.

²⁴ Paul C. Stern, *Blind Spots in Policy Analysis: What Economics Doesn’t Say About Energy Use*, J. Pol’y & Mgmt., Vol. 5, No. 2 (Winter 1986), at 200, 204-05.

²⁵ Howarth & Sanstad, *supra* note 20, at 107.

²⁶ Golove & Eto, *supra* note 21, at 10.

²⁷ Jeffrey A. Dubin, *Market Barriers to Conservation: Are Implicit Discount Rates Too High?*, Proceedings of a POWER Conference: The Economics of Energy Conservation, University of California Energy Institute, at 22 (1993).

²⁸ Howarth & Sanstad, *supra* note 20, at 107.

²⁹ Peter Whoriskey, ‘Cash for Clunkers,’ *household edition*, Washington Post, Nov. 27, 2009, available at <http://www.washingtonpost.com/wp-dyn/content/article/2009/11/26/AR2009112602420.html?referrer=emailarticle> (“While many economists believe that government incentives to lift consumer spending can boost the economy during a recession, they differ over whether the sales spikes that accompany the rebates are meaningful or merely concentrate sales that would have occurred before and after the rebate period anyway.”); compare Steven D. Levitt, (*Lots of*) *Cash for*

In evaluating the applicability of these criticisms to a Cash for Appliances program, it is critical to consider the divergent goals of the two programs. Cash for Clunkers had two primary goals: (1) boost the flailing U.S. auto industry by encouraging spending on cars during the recession; and (2) direct that spending toward fuel efficient vehicles that will help the environment and energy security.³⁰ Cash for Appliances, as proposed in this paper, does not assert economic recovery as one of its goals; rather, it asserts the primary goal of combating climate change. As such, this paper does not analyze whether Cash for Clunkers was an efficient mechanism for stimulating the economy, nor does it address the efficacy of Cash for Appliances *as a means of reviving the economy*. Instead, Cash for Appliances is evaluated only in light of its ability to address climate change and is compared only to other mechanisms designed specifically for this purpose.

Turning to the second cost issue, one report estimates that the cost of reducing a ton of CO₂ under Cash for Clunkers exceeded \$500 per ton, and in the best case scenario hovered around \$237 per ton.³¹ A comparison with the GHG abatement options on the McKinsey Global GHG Abatement Cost Curve (“the Abatement Curve”)³² demonstrates the extreme costliness of Cash for Clunkers as a means to address GHG emissions. The Abatement Curve portrays an array of options ranging from negative costs of 90 Euros up to 60 Euros per ton of CO₂ saved³³ – the \$500 per ton figure is literally “off the charts.”

Yet again, this comparison must be viewed in light of the twin goals of the Cash for Clunkers program. The competing goal of bolstering the auto industry (which arguably was the *primary* goal of the program) meant that the program was not optimally designed to reduce CO₂ emissions. To illustrate, the fuel efficiency requirements for purchasing new cars under Cash for Clunkers were feeble – new passenger cars purchased were only required to achieve a combined city and highway fuel economy rating of 22 miles per gallon (“mpg”).³⁴ Had the government set out to design a program

Clunkers, N.Y. Times, Freakonomics Blog, Nov. 2, 2009, available at <http://freakonomics.blogs.nytimes.com/2009/11/02/lots-of-cash-for-clunkers/> (commenting on statistic that 82% of the vehicles purchased under the program would have been bought that year even without the program), *with* David Leonhardt, *A Stimulus that Could Save Money*, N.Y. Times, Nov. 17, 2009, available at <http://www.nytimes.com/2009/11/18/business/economy/18leonhardt.html> (calling Cash for Clunkers the “one highly visible success of the stimulus program” and asserting that it “induced a boom in vehicle sales ... that clearly would not have happened otherwise”), *and* Whoriskey, *supra* (reporting that the Obama administration’s Council of Economic Advisors has asserted that Cash for Clunkers created 330,000 additional car sales).

³⁰ U.S. Department of Transportation Press Release, *supra* note 2.

³¹ Christopher Knittel, *The Implied Cost of Carbon Dioxide Under the Cash for Clunkers Program 1* (Center for the Study of Energy Markets, Working Paper No. 189, 2009).

³² McKinsey & Co., *Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve 7* (2009).

³³ *Id.*

³⁴ Consumer Assistance to Recycle and Save Program, Pub. L. No. 111-32, § 1302, 123 Stat. 1909 (2009).

targeted specifically at reducing CO₂ emissions, at the very least it would have raised the fuel efficiency requirements well above the 22 mpg level.

Thus, the concern about cost for the Cash for Appliances program is limited to two key questions: First, though the CfA program does not purport to generate appliance sales that would not have occurred anyway,³⁵ is the program necessary to direct sales toward energy efficient appliances? The answer to this question was answered in the affirmative in Part I.2 through the demonstration of market barriers. Second, is the program cost-effective for reducing GHG emissions compared with other possible abatement options on a dollars per ton basis? The answer again is a resounding yes. A back of the envelope calculation demonstrates that the current program has a negative abatement cost of approximately \$86 dollars per ton of CO₂ saved, and the proposed program has a negative abatement cost of \$132 dollars per ton of CO₂ saved (the discrepancy between the two scenarios, the calculation methods, and all assumptions are explained in the Appendix). The calculations are based on a number of contestable assumptions, but given the magnitude of the negative abatement costs, the program is likely to remain highly competitive with other options on the Abatement Curve under a variety of scenarios and assumptions.

Figure 1

	Existing program: \$296 million in funding	Proposed program: \$1.6 billion in funding (no budget constraints and rebates are given only to those trading in non-Energy Star appliances)
Cost to the government (what the government must pay to fund the program)	\$56/ton CO ₂ saved	\$34/ton CO ₂ saved
Cost to society (the net cost to society taking into account the costs to the government as well as the savings to consumers in the form of lower energy bills)	-\$86/ton CO ₂ saved	-\$132/ton CO ₂ saved

Part II – Existing Efforts Utilizing the Cash for Clunkers Model

Given the great success of Cash for Clunkers, it is not surprising that many have sought to mimic its structure. For example, the Long Island Power Authority is in the midst of a year-long program targeting refrigerators, providing consumers with a \$75 rebate when they purchase a new Energy Star refrigerator larger than 7.5 cubic feet, and

³⁵ See *infra* Part III.1.

an additional \$30 rebate to help with removal and disposal.³⁶ Similarly, a number of home furnishing stores have initiated programs whereby customers turn in old furniture or upgrade to Energy Star appliances in exchange for gift cards to the store. In one store in Johnstown, NY, old appliances and furniture are picked up at the time the new ones are delivered; the old goods are either donated or recycled, depending on the condition.³⁷ Most recently, President Obama has announced his consideration of a “Cash for Caulkers” program to provide households with incentives for home weatherization.³⁸

The federal government has also channeled the lessons from Cash for Clunkers into its own appliance-rebate scheme. The program uses federal stimulus money to implement section 124 of the Energy Policy Act of 2005, Energy Efficient Appliance Rebate Program (“Sec. 124”).³⁹ The stated goals of the program are to:⁴⁰

- Save energy by encouraging appliance replacement through consumer rebates
- Make rebates available to consumers
- Enhance existing rebate programs by leveraging Energy Star national partner relationships and local program infrastructure
- Keep administrative costs low while adhering to monitoring and evaluation requirements
- Promote state and national tracking and accountability
- Use existing ENERGY STAR consumer education and outreach materials

To effectuate the program, the Department of Energy will disperse \$296 million dollars of stimulus money⁴¹ to states or territories that submitted a plan by October 15, 2009 for administering a rebate program for Energy Star appliances.⁴² The state programs may be new or already in existence, and the money will be distributed based on state population.⁴³ States will have complete autonomy over the structure of the program

³⁶ Press Release, Long Island Power Authority, LIPA Announces “Cash for Clunkers” Refrigerator Replacement, Removal and Recycling Program (Aug. 20, 2009), available at <http://www.lipower.org/newscenter/pr/2009/>.

³⁷ Scelfo, supra note 3.

³⁸ Leonhardt, supra note 29 (providing details of Cash for Caulkers proposals).

³⁹ Energy Policy Act of 2005, Pub. L. No. 109-58, § 124, 119 Stat. 594, 617-18 (2005).

⁴⁰ U.S. Department of Energy, Idaho Operations Office, “Financial Assistance Funding Opportunity Announcement: State Energy Efficient Appliance Rebate Program (SEEARP),” No. DE-FOA-0000119, at 5 (July 14, 2009) [hereinafter, “The Announcement”], available at https://www.fedconnect.net/FedConnect/PublicPages/PublicSearch/Public_Opportunities.aspx.

⁴¹ Money provided by the American Recovery and Reinvestment Act (ARRA). See generally www.Recovery.gov.

⁴² Press Release, Department of Energy, DOE Announces Nearly \$300 Million for Energy Efficient Appliances (July 14, 2009), available at http://apps1.eere.energy.gov/news/daily.cfm/hp_news_id=178.

⁴³ Id. (providing link to funding allocations for each state and territory).

and the amount of the rebate offered for each appliance.⁴⁴ However, the federal government recommends for inclusion in all programs the following list of 10 appliances; states may propose other appliances for inclusion, but must explain their rationale for doing so in their applications:⁴⁵

- Boilers
- Central air conditioners
- Clothes washers
- Dishwashers
- Freezers
- Furnaces (oil and gas)
- Heat pumps (air source and geothermal)
- Refrigerators
- Room air conditioners
- Water heaters

However, as will be described in Part III, the existing federal program has significant limitations. The purpose of this paper is to highlight these defects and advocate for a new, amended version to follow the existing one. The legal structure for the program is already in place and thus a follow-on program should not be difficult.

Part III – Drawbacks of the Current Federal Program

1. Assumptions

Before proceeding, it is worth noting the assumptions on which the subsequent analysis rests. First, it is assumed that all of the appliances on DOE’s list of suggested appliances for inclusion in state rebate programs will provide a net benefit to consumers in dollars over the lifetime of the appliance if they participate in the rebate program.⁴⁶

Second, it is assumed that the benefits of including each appliance on this list – both in energy reductions and consumer savings – are well above those for appliances not on the list. That is, this list is the most effective starting point for a CfA program.⁴⁷

⁴⁴ Id.

⁴⁵ The list is structured to include “those residential Energy Star appliances that offer the greatest potential energy savings that are commonly included in existing utility or state consumer rebate programs.” See The Announcement, *supra* note 40, at 6.

⁴⁶ “Net benefit” means that the dollar amount of the rebate combined with savings in operating costs over the lifetime of the appliance exceeds the premium paid – if any – for an Energy Star appliance.

⁴⁷ Put differently, this paper assumes that the decision whether to include a certain appliance on the list was made based on a cost-benefit analysis that determines whether the rebate strategy is an efficient use of funds for each appliance (whether the difference in energy use between the Energy Star and older appliance is worth the money spent on rebates or whether the rebate money would be better invested elsewhere), and whether the rebate is sufficiently high to appeal to consumers.

Third, this paper assumes that the federal program – both the existing and potentially redesigned program – seeks to target only those consumers who were already in the market for a new appliance and does not target consumers whose appliances have years left on their expected lifespans. This assumption is based on a comparison between the sticker prices of the 10 targeted appliance categories and their rebate levels, and the unlikelihood that consumers would spend hundreds or thousands of dollars to replace, e.g. a central air conditioning system or furnace that was otherwise not in need of replacement, based on the sole incentive of a \$100 rebate.⁴⁸ This assumption forestalls the potential ridicule that “for Americans to be richer, they need to throw out their old appliances faster.”⁴⁹ It also embodies the idea that appliance purchases are less “elastic” than car purchases and thus less amenable to time-shifting.⁵⁰

Finally, it is worth reiterating that the CfA does not purport to stimulate the economy, as did the Cash for Clunkers program. Rather, the program’s primary objective is to reduce GHG emissions, though other benefits are predicted to flow from the program as well.⁵¹

2. Drawbacks

The federal CfA program has the capacity to generate substantial cuts in greenhouse gas emissions, and thus the program is a worthwhile pursuit. However, certain requirements – currently missing from the federal program – are critical to the success and efficiency of the program.

The existing federal program has three primary drawbacks that if addressed, would boost the financial efficiency of the program and secure greater long-term environmental benefits. First, the program does not discriminate between consumers who have already purchased Energy Star appliances in the past (and presumably will continue to purchase Energy Star appliances in the future) and those who have not. Thus, it wastes a non-trivial portion of funds on people who would have bought Energy Star appliances whether or not they received a rebate. Furthermore, the current CfA program makes no effort to overcome market barriers that might continue to deter this class of consumer – those who have not yet entered the Energy Star market – from purchasing Energy Star appliances after the rebate program expires. Second, the program does not require the disposal and recycling of old appliances. Third, the program allocates money based on population, rather than based on the fuel mix for electricity generation of each

⁴⁸ Rebate estimates taken from The Announcement, supra note 40, at Appendix B.

⁴⁹ Whoriskey, supra note 29 (describing criticism of economics Professor James D. Hamilton).

⁵⁰ Gabriel Nelson, *Energy Efficiency: ‘Cash for Appliances’ Starts with a Trickle*, Greenwire, Dec. 18, 2009, available at <http://www.eenews.net/Greenwire/2009/12/18/10/>.

⁵¹ See supra Part I.1 (describing a variety of social welfare gains from energy efficiency). The existing CfA program is also expected to spur job creation. On their applications for federal funds, states are required to estimate how many jobs their Cash for Appliances programs will create. See the Announcement, supra note 40, at Attachment 2, page 5.

state. Each of these drawbacks is described in further detail below, and solutions for addressing them in the context of a federal CfA program are proposed in Part IV.

A. Shortage of Funding and Inefficient use of Funds

A significant defect of the federal program relates to its target audience. As it stands now, the program does not make any effort to target only those consumers who would not have purchased an Energy Star appliance *but for* the rebate. Assuming that those consumers who have already purchased Energy Star appliances do not need a rebate incentive to continue purchasing Energy Star appliances in the future, then providing rebates to this group wastes resources that would be better invested elsewhere on the Abatement Curve.

A simple calculation demonstrates the financial import of this point. By multiplying the projected 2009 unit sales for each appliance by the approximate rebate level, one obtains the dollar cost of rebates for nine out of the ten appliance categories.⁵² If rebates were provided for all of the projected 2009 unit sales, the total cost of the rebates (not including administrative, disposal and other program costs) would be roughly \$2,346,390,220. Parsing this figure into rebate costs for past-Energy Star purchasers versus non-Energy Star purchasers, of the \$2.3 billion, \$724,520,513 would be used to pay for rebates for those people who had already purchased Energy Star appliances in the past. If the program could avoid paying rebates to those people who have already bought into the Energy Star idea – either because they understand the beneficial impacts on energy bills or they are environmentally aware, for example – program costs could be reduced by roughly 32%, to just over \$1.6 billion (see Figure 2). Though this strategy risks underinclusivity – presumably a fraction of the existing Energy Star appliance owners will not continue to purchase Energy Star products without an incentive to do so (perhaps they were dissatisfied with the product, or they inherited the product originally and are unaware of the significance of the Energy Star label) – this is likely to be a small fraction of the cohort and nevertheless not worth the \$724 million that could be put to use on alternative climate change abatement measures.

⁵² Water heaters were left out of the analysis due to insufficient data and the variability of efficiency depending on type. All data was taken from the Announcement, *supra* note 40, at Appendix B.

Figure 2

	Projected 2009 Total Category Unit Sales	Energy Star Market Share	Non-Energy Star Market Share	Rebate Levels (\$) (from preexisting programs)	Cost of rebates for appliances for people who already owned Energy Star appliances (\$)	Cost of rebates for appliances for people who did not previously own Energy Star appliances (\$)
Clothes washers	7,860,000	0.4	0.6	75	235,800,000	353,700,000
Dishwashers	5,486,000	0.4	0.6	25	54,860,000	82,290,000
Refrigerators	8,700,000	0.3	0.7	25	65,250,000	152,250,000
Freezers	2,046,250	0.03	0.97	25	1,534,687	49,621,562
Room Air Conditioners	8,660,495	0.5	0.5	20	86,604,950	86,604,950
Central Air Conditioners	4,233,080	0.21	0.79	100	88,894,680	334,413,320
Air Source Heat Pumps	1,768,260	0.18	0.82	250	79,571,700	362,493,300
Oil Furnaces	43,443	0.1	0.9	110	477,873	4,300,857
Gas Furnaces	2,128,234	0.32	0.68	110	74,913,836	159,191,903
Oil Boilers	119,732	0.61	0.39	300	21,910,956	14,008,644
Gas Boilers	188,485	0.39	0.61	200	14,701,830	22,995,170
Cost to government					\$724,520,513	\$1,621,869,707
Total						\$2,346,390,220

Thus, two lessons emerge going forward: First, the federal program as it stands is under-financed. The program provides \$296 million to states, whereas \$1.6 billion would be needed for rebates to meet the demand of consumers who were trading in non-Energy Star appliances (this says nothing of the added costs for administration and disposal). While about half of states have existing rebate programs⁵³ and those states are expected to continue to contribute state financing, it is unlikely that state funding would total the \$1.3 billion needed plus administrative and disposal costs.

Second, though the program has negative abatement costs (see Figure 1), the large absolute cost of the program reinforces the idea that it should narrowly target only those who require incentives to switch to Energy Star appliances. Part IV sets forth suggestions for how to distinguish between consumer groups and recommends ways to overcome market barriers that will pose obstacles to rational purchasing after the rebate program ends.

B. Insufficient Disposal Requirements

Another drawback to the federal program is the absence of a requirement for state recycling and disposal programs. This defect could have a number of pernicious effects:

⁵³ See Brian Hartman, ‘Cash for Refrigerators:’ *Like Clunkers, But for Appliances*, ABC News, Aug. 20, 2009, available at <http://abcnews.go.com/Technology/JustOneThing/story?id=8374739> (quoting Jill Notini of the Association of Home Appliance Manufacturers).

first, consumers could end up doubling their energy use by keeping both appliances (e.g. retaining an old room air conditioner for use alongside a new one). Second, consumers may choose not to participate in the rebate program at all without an easy, streamlined way of swapping out the old appliance. Indeed at least part of the success of the original Cash for Clunkers program derived from the simplicity of the program, involving essentially just a single transaction. Or third, consumers could dispose of old appliances in inappropriate, environmentally-damaging ways.

The guidelines for the current CfA program merely “encourage[] States to include in their program recycling of used appliances.”⁵⁴ Not surprisingly, the state proposals for federal money, submitted on October 15, 2009, vary widely in their plans for disposal and recycling programs. As examples, states such as California and Connecticut include stringent requirements for product disposal and recycling. California will distribute rebates only to those who replace and recycle their old appliances. The state requires proof of compliance and offers significant guidance and assistance to consumers for disposal.⁵⁵ In contrast, New York and Florida do not require consumers to trade in their old appliances, though both states encourage recycling by providing an extra \$25-75 for those who can demonstrate proof of disposal. Neither state assists with disposal directly, though NYSERDA – the public benefit corporation administering New York’s CfA program – plans to coordinate efforts within New York City to ensure consumers have disposal options available.⁵⁶

Furthermore, the federal government prohibits states from using federal money for direct recycling costs; they may only use the funds to administer recycling programs,⁵⁷ and, administration costs must be kept within 10-25% of the total program costs.⁵⁸ Thus, the federal program provides no incentive to states to actually implement and subsidize an effective, comprehensive recycling program.

C. Allocation of Money Based on Population

A final obstacle in the current program is the allocation of funds based on state population. In the context of a climate change-focused program with limited funding, a population allocation system does not make efficient use of government funds. As

⁵⁴ American Recovery and Reinvestment Act of 2009 (ARRA): State Energy Efficient Appliance Rebate Programs, Questions, at 5 [hereinafter “Questions”], available at www.drintl.com/energystar/FedConnect_Questions-Answers_Posted_12Aug09.pdf.

⁵⁵ California Energy Commission Application for Solicitation: DE-FOA-0000119, at 10 (Oct. 14, 2009), available at <http://www.energy.ca.gov/recovery/energystar.html>.

⁵⁶ Email on behalf of Tina Blowers to News-L@Listserve.NYSERDA.org, “New York’s Great Appliance Swap Out” Program Approved (Dec. 7, 2009) (on file with author); Florida Energy & Climate Commission, Florida Energy Star Appliance Rebate Program, available at http://myfloridaclimate.com/climate_quick_links/florida_energy_climate_commission/energy_star_appliance_rebate_program.

⁵⁷ Questions, supra note 54, at 3-5.

⁵⁸ The Announcement, supra note 40, at 6.

discussed below,⁵⁹ distribution based on fuel mix would optimize the use of government funds in a CfA program.

Part IV – Suggestions Going Forward

Though the current program is already underway, this paper predicts that the money allocated will make only a small dent in the potential energy savings. Thus this paper advocates viewing the current effort as a pilot program and incorporating these suggestions into a second program with new funding. Even without a second round of funding from the federal government, these suggestions are recommended for incorporation into ongoing individual state programs.

1. Target Only Those Who Need Incentives to Buy Energy Star

This paper suggests that only those who are trading in non-Energy Star appliances should qualify for a rebate on a new appliance. Categorizing consumers based on prior choices creates an imprecise but practical proxy for narrowing the program and cutting costs. It also answers the concern of the Cash for Clunkers critics who argue that the program was wasteful because the car sales would have occurred anyway.⁶⁰ This proxy certainly risks underinclusivity – it assumes people who purchased a certain type of good in the past will continue to purchase that type of good in the future.⁶¹ However, this paper asserts that the opportunity cost of forgoing alternative climate change mitigation strategies is too large to justify expensive rebates for all consumers.

The mechanics of a program targeting consumers based on current appliance ownership are fairly straightforward. Assuming that disposal of the old appliance is a mandatory condition of the program,⁶² one can monitor and enforce this categorization by either directly viewing the old appliance when it is retrieved for disposal, or by requiring third-party verification of disposal – including a brief description of the appliance that was given up.⁶³ To be sure, these enforcement mechanisms do not wholly prevent gaming of the system. A consumer might use a relative’s unwanted old appliance for trade-in and keep her own Energy Star appliance for continued use alongside the new one. Or, forgery of the disposal paperwork is possible. Nonetheless, this paper presumes that because opportunities for cheating are low (for many of the appliance categories a second appliance of that type would not be useful or desirable) and because there are sufficient ways in which a customer could “get caught” in the process of cheating, this concern is relatively mild.

⁵⁹ See *infra* Part IV.4.

⁶⁰ See *supra* note 29 and accompanying text.

⁶¹ See *supra* Part III.2.A.

⁶² See *infra* Part IV.3.

⁶³ *Id.* (discussing and recommending California’s disposal system which enlists “Official Partners” to perform functions such as third party verification).

2. Facilitate Market Transformations by Mitigating Implicit Discount Rates

While part of the purpose of a CfA program is conversion of the existing appliance stock to more energy efficient models, an equally important goal should be the transformation of markets to encourage preferences for energy efficient products. As discussed in Part I.2, many barriers exist that inhibit consumer investments in energy efficient products. Yet structured appropriately, a CfA rebate program can serve as a vehicle for overcoming these barriers both in the short term (during the life of the rebate program) and the long term.⁶⁴ To this end, this paper recommends several tools through which a rebate program can bolster consumer participation in the CfA program, overcome market barriers, and facilitate long-term market transformation in support of energy efficient products. The barriers and accompanying proposals may be grouped into two categories: information obstacles and split incentives.

A. Information Obstacles

Many of the market barriers to energy efficient appliances – lack of information, rushed decisions, risk aversion, bounded rationality and upfront capital costs – are rooted in the fundamental problem of an information deficit. Often consumers are simply unaware of the potential environmental and financial benefits of an Energy Star appliance. Or, though the information is available to consumers, it is sufficiently unfamiliar or complex to assist in rational decision making. These obstacles are exacerbated in the context of rushed decisions: accessibility and clarity of information are critical when consumers have little time to research products. In addition, information barriers may intensify the risk aversion of many consumers: when buyers are confused or insecure about the payoffs of a new product, they will not be inclined to invest in it. Finally, information obstacles relate to the problem of upfront capital costs as well. A budget-conscious consumer choosing between two refrigerators, for example, may opt for the less energy efficient one because it is cheaper; but armed with information about savings in operating costs, the consumer might well be inclined to select the more efficient refrigerator.⁶⁵

⁶⁴ Michael Gibbs & Jeanne C. Townend, *The Role of Rebates in Market Transformation: Friend or Foe?*, American Council for an Energy-Efficient Economy 2000, Summer Study on Energy Efficiency in Buildings, at 6.121.

⁶⁵ Of course the problem remains that certain consumers simply do not have the financial means to pay the higher upfront costs at the time of purchase. This difficulty can be alleviated in the short-term with a CfA rebate. In the longer term, to the extent that energy efficient appliances do not achieve a cost-competitive status in the market place, government programs should continue to subsidize upfront costs for low-income consumers. For example, New York's Energy Smart Loan Fund program provides loans for a number of home efficiency improvements, including the purchase of Energy Star appliances. See, e.g., New York State Energy Research and Development Authority, Financing for Single Family Homes, available at <http://www.getenergysmart.org/SingleFamilyHomes/ExistingBuilding/HomeOwner/Financing.aspx>.

Information obstacles are unlikely to pose a significant problem for consumers during the life of the rebate program. A well-advertised, simple program that offers sufficiently large rebates should arguably be adequate for directing consumers already in the market for new appliances towards energy efficient models. However, for a CfA rebate program to shift consumer preferences for the long run, it is critical that “consumers trying these products ... find [Energy Star products] superior to the less efficient alternatives.”⁶⁶ Assuming the performance, features, and maintenance requirements of appliances are comparable across efficiency categories, the primary performance metric for consumer satisfaction will be operating cost.

Thus, a primary objective of the rebate program should be to demonstrate to consumers – with concrete, empirical, clear information – the actual monetary savings achieved from an energy efficient appliance. This suggestion finds support in marketing techniques derived from behavioral studies and “prospect theory.”⁶⁷ Because “[c]onsumers try to anticipate and avoid feelings of regret,” the most effective policy tools will offer consumers “what they want: sure, even if modest, gains.”⁶⁸ States should therefore incorporate educational and marketing components into CfA programs. Distributing Energy Star information to consumers who participate in the rebate program should be a given for all states. However, these efforts should be supplemented with more direct, penetrating efforts to raise awareness about household energy consumption.

Two tools are highlighted below for state adoption that would raise awareness about the cost-savings from energy efficient appliances, would be fairly easy to administer in conjunction with a CfA program, and would help maintain demand for Energy Star appliances after the end of the CfA program. The federal government should encourage the use of these tools and simultaneously stress to states the importance of ongoing education campaigns about energy efficiency.

a) Utility Bills as a Mechanism for Framing

When customers take advantage of the initial CfA rebate, retail stores could provide them with a model utility bill that compares the monthly operating cost of a non-Energy Star appliance with that of an Energy Star appliance.⁶⁹ Cost savings and extrapolated payback periods should be painstakingly clear and accessible.

A more interesting version of this approach would be to enlist utility companies as partners in this effort and include the comparison on the consumer’s personal bill. It would be administratively overwhelming to break each bill down by appliance and issue a comparison for each. However, a general information sheet with simple cost-comparisons for each appliance category according to energy prices for that particular month could provide consumers with an ongoing, simple, empirical indication of how

⁶⁶ Gibbs & Townend, *supra* note 64, at 6.122.

⁶⁷ “Prospect theory emphasizes behavioral description rather than pure rationality and suggests that under conditions of uncertainty, individuals derive markedly asymmetrical ‘values’ for a financial loss as compared to a financial gain.” Vinayak Bhattacharjee, Charles J. Cicchetti, & William F. Rankin, *Energy Utilities, Conservation, and Economic Efficiency*, XI Contemporary Policy Issues at 69, 72 (Jan. 1993).

⁶⁸ *Id.* at 69, 73.

⁶⁹ See *id.* (discussing framing techniques to promote conservation).

much money they can save on their utility bills with Energy Star appliances. While this strategy would require coordination between the state and utility companies, the CfA should encourage such partnerships and maintain flexibility at the state level to this end.

b) Energy Audits

A second mechanism for disseminating information about appliance efficiency is a home energy audit program. Many states already provide residential energy audits. As an example, New York's NYSERDA Home Performance with Energy Star program links consumers with contractors who will assess a home, make recommendations for efficiency improvements, and then perform the work if desired.⁷⁰ Offering a free energy audit to customers participating in the rebate program publicizes the audit program and presumably entices at least some portion of consumers to take advantage of it. Once a consumer has an energy audit performed on her home, whether or not she proceeds with retrofits immediately, she will be more knowledgeable and equipped to consider efficiency in future purchasing decisions.

The federal government should not require states to adopt audit and utility bill programs in order to receive money for a CfA program; states are better-equipped to determine what type of information program would fit well within existing state efforts. However, the federal government should make the receipt of federal funds for CfA contingent on the demonstration of a strong, targeted information-dissemination program to facilitate a market transformation toward energy efficient products for the long run.

B. Split Incentives

Split incentive problems – often described in principal-agent terms⁷¹ – develop when the costs and rewards of energy efficiency investments run to different parties. The most common example of split incentives relating to residential appliances arises in the rental-housing context. This paper focuses on this landlord-tenant situation in detail given that rental units comprise approximately 35% of housing in the country.⁷² Furthermore, a recent study suggests that 31.4% of the total energy use for refrigerators, space heating, water heating, and lighting in the U.S. suffers from a principal-agent problem.⁷³ Thus, the magnitude of the split incentive problem is significant and methods for addressing it should be woven into a CfA program.

Rental contracts can produce split incentives in two directions: In one scenario landlords lack incentives to purchase energy efficient appliances because tenants pay the utility bills and thus will reap the financial returns of these investments. In the opposite

⁷⁰ New York State Energy Research and Development Authority, Home Performance with ENERGY STAR, at <http://www.getenergysmart.org/SingleFamilyHomes/ExistingBuilding/HomeOwner.aspx>.

⁷¹ International Energy Agency, Mind the Gap: Quantifying Principal-Agent Problems in Energy Efficiency (2007), at 27, 31, available at <http://www.iea.org/w/bookshop/add.aspx?id=324>.

⁷² U.S. Census Bureau, Housing Vacancies and Homeownership, available at <http://www.census.gov/hhes/www/housing/hvs/qtr309/q309tab5.html>.

⁷³ International Energy Agency, *supra* note 71, at 191.

direction, tenants are reluctant to invest in efficiency upgrades either when the landlord pays the utility bills or when tenants are uncertain whether they will be living there long enough to recoup the investment. The CfA program is itself a partial solution to the split incentives problem. Given that CfA targets only those who are already in the market for a new appliance, the rebate makes Energy Star appliances a financially more attractive option by effectively decreasing the payback period (a lower investment upfront means that less time is required to recoup the investment – thus, e.g., a tenant may feel more confident she will not move before the end of the payback period). However, two problems linger: first, to the extent that one pays a premium for Energy Star appliances, landlords may not recoup their full investment solely in the form of the rebate. Second, once the CfA money runs out, the partial mitigation of the problem from the CfA program evaporates. Thus, the CfA program should require states to build in certain mechanisms that will address split incentive problems beyond the life of the rebate program.

The literature suggests three primary ways to address split incentives: (1) contract redesign; (2) regulatory tools such as standards and building codes;⁷⁴ and (3) information distribution.⁷⁵ In the context of the CfA program, landlords and tenants must be treated separately, and contract design provides the most useful mechanism for mitigating split incentives.⁷⁶

a) Treat Tenants and Landlords Separately

While both landlords and tenants care about upfront costs, the extent to which they will overcome this concern depends primarily on whether they will later recoup these costs in the form of lower energy bills. This problem simply cannot be overcome without reference to two distinct variables: who selects and pays for the appliance and who pays the energy bill. Thus, four scenarios are possible (see Figure 3):

⁷⁴ Regulatory options embody a wide range of efforts, including, for example, typical performance standards and codes; Residential Energy Conservation Ordinances (RECOs) which require efficiency upgrades to existing buildings before they can be sold or renovated; or Pay-As-You-Save (PAYS) systems, whereby the upfront costs of efficiency upgrades are subsidized and repaid over time by the consumer through savings in energy bills. See Beth E. Williams, Masters Thesis, *Overcoming Barriers to Energy Efficiency for Rental Housing*, Massachusetts Institute of Technology, at 30-34 (2008), available at <http://dspace.mit.edu/handle/1721.1/44348>.

⁷⁵ *Id.* at 38; International Energy Agency, *supra* note 71, at 191.

⁷⁶ The other two tools will not be discussed: appliance standards and building codes are extremely important mechanisms for energy efficiency, but this paper takes the view that linking building codes with a CfA program would impose unnecessary administrative costs. Specific information tools have already been identified and suggested for incorporation into the CfA program. See *supra* Part IV.2.A.

Figure 3⁷⁷

	Tenant chooses the appliance	Landlord chooses the appliance
Tenant pays energy bill	Scenario 1: No Split Incentives problem	Scenario 2: Efficiency problem
Landlord pays energy bill	Scenario 3: Usage & Efficiency problem	Scenario 4: Usage problem

Because the CfA does not purport to change the quantity of usage of appliances by end users, the focus here is on scenarios 2 and 3.

Scenario 2

When scenario 2 is in play, the CfA should make sure that the landlord recoups almost all of her investment in an energy efficient appliance. This could be accomplished in two ways: provide landlords with a larger rebate than consumers (the latter group will recoup costs through energy bills), or, facilitate a state-run program whereby landlords and tenants can enter into contracts such as “green leases” that help align their incentives.

The viability of the former option – providing landlords with a higher rebate – would depend on the price of the appliance, the premium paid for an Energy Star appliance (the difference between the cost of an Energy Star appliance and the cheapest appliance on the market – or rather, the appliance the landlord is otherwise likely to purchase). Thus, in order to pay landlords higher rebates, the premium for Energy Star must be sufficiently small to allow that difference to be made up through the added rebate. To finance this, a state might decrease rebates to the consumers in Scenario 1 by a small amount.

An alternative approach would facilitate contracts between landlords and tenants that would allow landlords to share in the gains from the reduced operating costs. One such option would be a “green lease,” or a contract stating that the landlord may raise the rent by an amount *less than* the expected monthly energy savings received through energy efficiency measures paid for by the landlord.⁷⁸ To be sure, the green lease poses a number of potential problems: it may be difficult to estimate monthly savings from a given appliance, and tenants may be wary that they will bear the burden of this endeavor – particularly tenants with high energy bills; there may not be sufficient trust or amicability between landlords and tenants to strike such a deal; and low income tenants may oppose rent increases, even if these increases are offset by energy savings.⁷⁹ Nonetheless, the state could help solve the first two problems by providing, through a CfA program, a third-party auditor to help determine energy savings and set the appropriate rent level. Furthermore, rent offsets could be calculated annually based on the consumer’s actual, rather than projected savings. With regard to the last problem, the

⁷⁷ International Energy Agency, *supra* note 71, at 34.

⁷⁸ Williams, *supra* note 74, at 36.

⁷⁹ *Id.* at 37.

CfA should recommend that landlords and renters take advantage of other subsidies directed at retrofitting low-income housing, rather than participate in green leases.

Scenario 3

In scenario 3, a similar problem occurs, but the incentives are reversed. Because the landlord pays the energy bill, the tenant has no incentive to select an energy-efficient appliance if the rebate does not cover the whole cost of the Energy Star premium. Again, a “green lease” method could address this issue in the form of rent reductions for the tenant and achieve an end result where both parties still come out ahead.

Though potentially difficult to structure at first, a collateral contracting program would have the benefit of lasting long after funds for rebates have evaporated.

3. Require Comprehensive Disposal Programs

The CfA encourages states to implement a disposal and recycling program alongside their CfA programs. In reality, however, there is significant diversity among state disposal programs.⁸⁰ Furthermore, the refusal of the federal government to allow federal funds to be used for disposal costs constrains states further in this effort. This paper argues that a comprehensive disposal program should be a mandatory condition for receiving federal funds for a CfA and that federal money should be used to help operate these programs.

An example of a comprehensive disposal plan should be provided to states applying for funds, and California’s program serves as a useful prototype. California’s recycling program includes the following components:⁸¹

- Mandatory recycling of old appliances when a rebate is received for purchase of a new appliance;
- Enlisting “Official Partners” – including utilities, appliance retailers and manufacturers, recyclers, and marketers – to pick up and dispose of appliances;
- Requiring Official Partners to dispose of the appliances in conformance with state standards as well as U.S. EPA’s Responsible Appliance Disposal criteria.⁸²

All states should be required to demonstrate that they have adopted this framework or an equally robust program.

4. Distribute Money to States Based on Fuel Mix, Not Population

The current CfA program distributes money to states based on state population. However, a dollar of investment in one state does not necessarily create the same environmental benefits that a dollar of investment in another might have. That is, all

⁸⁰ See supra Part III.2.B; Nelson, supra note 50 (“Rebate programs will vary widely around the country, in part because many state governments and utilities already offer incentives on efficient appliances.”).

⁸¹ California Energy Commission Application for Solicitation, supra note 55, at 8-11.

⁸² See U.S. EPA, Ozone Layer Depletion – Partnerships: Responsible Appliance Disposal (RAD) Program, available at <http://www.epa.gov/ozone/partnerships/rad/>.

dollars are not created equal when it comes to energy efficiency investments across states. The discrepancy derives from the variability in fuel mix for electricity generation across states and regions. To illustrate:

Figure 4⁸³

	lbs CO ₂ /kWh
North Dakota	2.24
Idaho	0.03

Thus, because a dollar of efficiency improvements goes so much farther in terms of CO₂ reductions in North Dakota than Idaho, distributing funds based on fuel mix would optimize the use of government funds under certain conditions.

If government funds for the federal CfA program were unlimited, then the method of distributing funds might not matter – everyone who had a non-Energy Star appliance could upgrade and receive a rebate. Where rebate demand exceeds government funds for the program, however, ensuring that upgrades occur in dirty states is a more productive strategy.⁸⁴

The difficulty then lies in the political backlash that might occur by using a fuel mix allocation system. Clean states may correctly view distribution based on fuel mix as essentially a penalty for maintaining a clean fuel mix. It may also create perverse incentives for state governments to maintain dirty mixes. Nonetheless, the federal government could appease these angered states and demonstrate reciprocity of advantage by linking the CfA program with other climate change initiatives that penalize high polluting states. Furthermore, the perverse incentives would only arise if CfA were an ongoing program; if that were the case, the Department of Energy could shift its distribution criteria over time to provide more effective incentives to switch to cleaner fuel sources. Finally, concessions to dirtier states may be needed in order to muster political support for climate change initiatives; providing a boon to dirtier states in the context of a short-lived CfA program could be a relatively harmless way to provide such a concession.

⁸³ Data taken from Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program, available at <http://www.eia.doe.gov/oiaf/1605/ee-factors.html>.

⁸⁴ Using the availability of government funds as the determining factor for whether to allocate federal funds based on population or fuel mix does not ensure optimal use of funds. Selecting the optimal distribution method depends on a number of factors, including: fuel mix and population of each state, types of appliances used in each state and frequency of usage, the level of state funds allocated to the CfA program, and the number of residents likely to turn in an appliance in a given year. This paper draws a broad brushstroke, estimating the optimal distribution mechanism, but the existing Cash for Appliances program might provide a significant data source from which a more thorough calculation may be made.

Conclusion

At this moment, states are gearing up to kick off their CfA programs under the initial funding disbursement. Though the ultimate success of the program remains to be seen, certain shortcomings are evident from the outset: lack of funding, not distinguishing among consumers, inattention to market barriers such as information problems and split incentives, lack of a stringent disposal requirement, and distribution of funds based on population.

This paper suggests that a second round of CfA funding, conditioned on incorporation of these proposals, could make great strides in CO₂ emissions reductions. To be sure, the requirements proposed are quite stringent. Nonetheless, tackling climate change is going to require robust changes and serious commitments – shying away from a new CfA program because it requires a concerted effort would forgo an important energy efficiency opportunity.

At the same time, the value of the program should not be overstated. The program could make a significant dent in upgrading the efficiency of the existing appliance stock; but the program will be most effective alongside a wide variety of complimentary abatement efforts including efficiency standards and national cap and trade legislation. Nonetheless, should the program witness the same great success as Cash for Clunkers, opportunities for expanding it to businesses and broadening the scope to other appliances, electronics, and weatherization techniques – as the government has started to consider – lay within reach.

Finally, the political will needed to pass this program is attainable. The program is notable for its efforts to combat climate change, but at the same time it may boost the sale of appliances and put money in the hands of consumers during a time of economic downturn. Potentially the program could even go a step further and require that appliances that qualify for the rebate be American made. In the mean time, a more robust, stringent CfA program could be implemented in the near term and make significant strides in energy efficiency toward the goal of combating climate change.

APPENDIX

	Existing program: \$296 million in funding	Proposed program: \$1.6 billion (no budget constraints and rebates are given only to those trading in non-Energy Star appliances)
Cost to the government (what the government must pay to fund the program)	\$56/ton CO ₂ saved	\$34/ton CO ₂ saved
Cost to society (the net cost to society taking into account the costs to the government as well as the savings to consumers in the form of lower energy bills)	-\$86/ton CO ₂ saved	-\$132/ton CO ₂ saved

- **Data:** All input data was taken from the existing federal CfA guidelines (“The Announcement”).⁸⁵
- **Difference between the two scenarios:** The two funding scenarios have different abatement costs per ton CO₂ saved because in the existing program, the \$296 million is allocated among appliances in proportion to the projected sales of each appliance. In the unconstrained scenario, the \$1.6 billion is allocated in proportion to the projected sales of non-Energy Star appliances.
- **Assumptions:**
 - 7% discount rate (also used in the McKinsey & Co. abatement curve calculation)
 - Constant energy savings over the life of the appliance (i.e., no degradation in efficiency gains)
 - 12 year lifespan for every appliance
 - All energy costs 11 cents per kilowatt hour (oil and gas use was converted to kilowatt hours). Because oil and gas power a small fraction of the appliances, this should not distort the numbers significantly.

⁸⁵ U.S. Department of Energy, Idaho Operations Office, “Financial Assistance Funding Opportunity Announcement: State Energy Efficient Appliance Rebate Program (SEEARP),” No. DE-FOA-0000119 (July 14, 2009), available at https://www.fedconnect.net/FedConnect/PublicPages/PublicSearch/Public_Opportunities.aspx.

- The \$1.6 billion scenario assumes 100% success of the program: everyone who is eligible for a rebate (i.e. does not already own an Energy Star appliance) takes advantage of the rebate program.
- **\$296 Million Scenario – How the numbers were calculated**
 1. Allocate the \$296 million to the appliance categories in proportion to projected unit sales.
 2. To find out how many units will actually be rebated, divide the money allocated to each category by the expected rebate.
 3. To find the total energy savings for an appliance category, multiply the number of rebated appliances by the annual energy savings per appliance (the difference between Energy Star and non-Energy Star) times the non-Energy Star market share. This assumes that new Energy Star appliances that replace old Energy Star appliances have no energy savings.
 4. Use emissions factors to convert energy savings into CO₂ savings.
 5. To calculate the money that consumers save, multiply the annual energy savings by the average electricity cost of 11 cents per kilowatt hour
 6. Calculate the net present value of 12 years of energy savings at a 7% discount rate.
 7. Divide total cost by total CO₂ savings.
- **\$1.6 Billion Scenario – How the numbers were calculated:**
 1. Multiply expected sales of appliances by the non-Energy Star market share to get the expected sales of appliances to consumers trading in non-Energy Star appliances.
 2. Assume rebates are given for every sale of an Energy Star appliance to each person trading in a non-Energy Star appliance.
 3. Energy savings for each appliance category is the projected Energy Savings for Energy Star appliances multiplied by the number of units sold in each category.
 4. Follow steps 4-7 from the \$296 million scenario.