Consumer Federation of America
1620 I Street, N.W., Suite 200 * Washington, DC 20006

A CONSUMER ANALYSIS OF THE ADOPTION OF THE CALIFORNIA CLEAN CARS PROGRAM IN OTHER STATES: ARIZONA

Mark Cooper,
Director of Research

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INTRODUCTION

The Clean Air Act of 1970s embodies the principle of cooperative federalism in a unique manner. California, which had suffered from particularly severe air pollution problems, was allowed to adopt standards that exceeded the national vehicle emission standards. In 1977, with more cities facing pollution problems, Congress allowed other states to also adopt stricter standards by adopting the California standard. Fifteen states have gone to court in support of the California Program.[1]

One of the key considerations in deciding to adopt the program is the impact it would have on consumers. The Consumer Federation of America[2] has prepared a consumer analysis of the impact of adopting the California Clean Cars program in other states. Arizona is considering adopting the program[3] This analysis answers the key question: **How will the California Clean Cars program affect the consumer?**

PURPOSE

Prior analyses have shown that the Clean Car Program is in the consumer interest.[4] We agree with those findings. In fact, we believe that prior studies underestimate the benefit that consumers will get from the program for three reasons:

First, by and large, the studies were done over two years ago. The value of reduced greenhouse gas emissions and the reduction in gasoline consumption that occurs as a result of efforts to lower emissions has increased dramatically since the studies were done.

[1] http://www.calcleancars.org/news.html
[2] The Consumer Federation of America (CFA) is a non-profit association of approximately 300 consumer groups in 45 states including Arizona. It was established in 1968 to advance the consumer interest through research, advocacy and education.
[3] Arizona Environmental Improvement Board Docket # EIB No. 07-9 (R), Nov. 14, 2007 Hearing on Emissions Standards for New Motor Vehicles, 20.2.88 NMAC; Albuquerque-Bernalillo County Air Quality Control Board Emission Standards for New Motor Vehicles, 20.11.104 NMAC Hearing on Nov. 27, 2007
[4] California Environmental Protections Agency, Air Resources Board, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider Adoption of Regulations to Control Greenhouse Gas Emissions from Motor Vehicles,* August 6, 2004 (hereafter CARB); Spencer Quong, *The UCS Vanguard: A Vehicle to Reduce Global Warming Emissions Using Today's Technologies and Fuels* (Union of Concerned Scientists, March 2007) (hereafter, UCS).

Second, the studies emphasized direct benefits – the value of reduced gasoline consumption on the price of gasoline. However, there are other indirect benefits that are ultimately enjoyed by consumers whose importance has grown as the external costs of gasoline consumption have increased. These include increased vulnerability to supply disruptions, national security problems associated with greater reliance on imports from and greater wealth transferred to nations that are hostile to our interests, health care costs associated with pollution, and the impact of global warming.[5] We believe these should also be considered. Therefore, we applied two tests to the program, a consumer pocketbook test and a societal cost benefit test.

Finally, we also find that the existence of numerous studies, done by different researchers at different times for different purposes, may create a mistaken impression that there is imprecision in the cost benefit analysis. This impression is mistaken because a significant part of the difference in estimate reflects the fact that different analyses modeled different technologies with different assumptions about price, benefit measures, discount rates, etc. When one standardizes the analysis around a common set of assumptions and parameters and recognizes that different vehicles are being examined, the analyses prove to be more consistent than appears at first glance.

Thus, the purpose of these comments is to present the Board with an analysis of adopting the Clean Cars program based on an up-to-date, systematic assessment of the direct and indirect benefits for the consumer, measured in terms of the pocketbook impacts and societal costs and benefits.

APPROACH

Economic Fundamentals

At the core of each of the prior analyses is a simple concept that we accept. Technologies are included in vehicles to reduce greenhouse gas emissions. These technologies have a cost, which is estimated by the analyst. The analyst builds a vehicle by estimating the cost of technologies that reduce emissions in compliance with the program. These technologies also have the effect of lowering the operating cost of the vehicle.

For the purpose of this analysis, we examine nine generic "vehicles" that have been offered as compliant by the California Air Resources Board (CARB) and the Union of Concerned Scientists (UCS).[6] CARB estimated the lifecycle cost of over three dozen technologies in five vehicle categories (small car, large car, minivan, small truck and large truck).[7] They then considered "logical combinations of these technologies"[8] and found that "nearly all technology combinations modeled provided reductions in lifetime operating costs the

[5] See Mark Cooper, *50 by 2030* (Washington, D.C.: Consumer Federation of America, May 2006, available at: http://www.consumerfed.org/pdfs/50_by_2030.pdf, and Mark Cooper *No Time to Waste* (Washington, D.C.: Consumer Federation of America, October 2007), available at http://www.consumerfed.org/pdfs/No_Time_To_Waste.pdf, for a discussion of the treatment of externalities.

[6] CARB

[7] Id., p. 83.

[8] Id., p. 101.

retail price of the technology."[9] They combined these automotive technologies into conventional fuel vehicles that are compliant with the Clean Car program. CARB also considered alternative fuel vehicles and found that "two alternative fueled vehicle technologies are also projected to provided positive life cycle cost benefits when compared to convention vehicles."[10]

The CARB analysis uses four "vehicles" that reflect these bundles of technologies. There are two conventional vehicles: "passenger cars and light duty trucks with test weights under 3751 lbs. loaded vehicle weight (PC/LDT1)"[11] and light duty trucks with test weights between 3751 lbs. loaded vehicle weight and 8,000 lbs. gross vehicle weight (GVW) (LDT2)."[12] There are two alternative fuel vehicles. "These include LPG and HEV with an all-electric range of 20 miles."[13] The alternative fuel vehicles that were found not to be cost effective at the assumed values for 2003 might be cost effective at today's higher values, but for this proceeding, we take the cautious path and examine only those that passed the test in the original CARB analysis.

UCS took the CARB analysis one step further in an approach that "combines climate-friendly automotive technologies with the use of biofuels in one vehicle (p. 1)."[14] The UCS analysis gives us estimates for one vehicle in each of the five vehicle types identified by the CARB. Thus, there are nine generic vehicles – two conventional fuel vehicles, two alternative fuel vehicles, and five that mix alternative fuels and automotive technologies.

As a result of the utilization of technologies to reduce greenhouse gas emissions, vehicles will consume less gasoline, which results in a reduction in the operating cost of the vehicle. This estimate is based on a number of assumptions, such as how many miles per year is the vehicle driven? What is the difference in fuel consumption?

Multiplying the reduction in gasoline use by the price of gasoline, one arrives at the value of the operating cost savings.

A financial analysis is laid over these basic elements. The analyst chooses an economic criterion (e.g. cash flow, payback, and benefit-cost ratio), a period (e.g. life of the loan, lifecycle) and an interest rate or discount rate to assess the investment.

Societal Cost-Benefit

The societal cost benefit test uses the same economic fundamentals but it values the reduction in fuel consumption higher. It includes the value of external costs that are avoided. The concept of external costs and benefits is widely recognized in the social sciences.[15] These costs and benefit are indirect. However, if we take the concept of externalities seriously, which we should as they are real and, ultimately, real people feel the indirect effects, pay the costs and reap the benefits.

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[9] Id., p. 102.
[10] Id., p. 102.
[11] Id., p 104.
[12] Id., p. 104.
[13] Id. p. 102.
[14] UCS, p. 1.
[15] For example, introductory tests, such as John B. Taylor, Economics (Boston: Houghton Mifflin, 1998), second edition, pp. 412-425, include the topic.

Consumption of gasoline is a major cause of pollution, emissions of global warming greenhouse gases, and a large household expenditure. Policies to require the reduction in emissions of pollutants and greenhouse gases will promote the reduction in the use of gasoline. Thus, an unintended, but inevitable consequence of adopting policies to reduce greenhouse gas emissions will be to reduce household expenditures on gasoline.

Many of the societal costs of burning fossil fuels result in societal expenditures which are paid for in taxes. Many analysts believe that excessive oil dependence increases the military expenditure to protect American interests in oil producing regions. The drag on the economy created by the drain of local resources out of the national economy and the vulnerability to economic disruptions as a result of huge imports of crude oil is felt across many sectors. Many of the health effects of auto emissions are felt locally. The global effects will be felt locally.

Thus, we believe it is a mistake not to quantify and personalize these external costs and benefits. The key is to use a method that reasonably reflects these external values in a way that suggests the impact consumers will feel. Our approach is to increase the estimated value of gasoline used in the analysis.

Conducting two separate analyses can result in a quandary, when the results point in opposite directions. If the results of the consumer pocketbook analysis is negative, but the results of the societal cost benefit test is positive, the relative size of the effects and the difference between direct and indirect effect can make for a complex decision and a tough call. Fortunately, that is not the case with the policy decision before the Boards. We find that the adoption of policies to reduce greenhouse gas emissions will have a positive net benefit under both the consumer pocketbook test and the societal cost-benefit test.

This approach was applied to the nine vehicles that comply with the Clean Cars program that were analyzed by the California Air Resources Board and the Union of Concerned Scientists. The approach is to use the operating cost savings to also value the societal benefits by placing an adder on the price of gasoline. This approach keeps the analysis simple, but it underestimates the societal benefits slightly because there are reductions in greenhouse gases that are achieved with measures that do not affect operating costs.[16]

The details of the analyses are described in the Appendix to these comments. Exhibit A-1 in the Appendix describes fundamental parameters of the analysis. Exhibit A-2 in the Appendix presents details on the estimation of the consumer pocketbook and societal cost benefit analyses.

RESULTS

Consumer Pocketbook

In the original analyses, gasoline prices were set in the range of $1.74-$2.55 per gallon, but six of the eight vehicles had positive cash flow for the consumer. That is, the monthly savings in operating costs exceed the increase in the loan payment for the lower emission

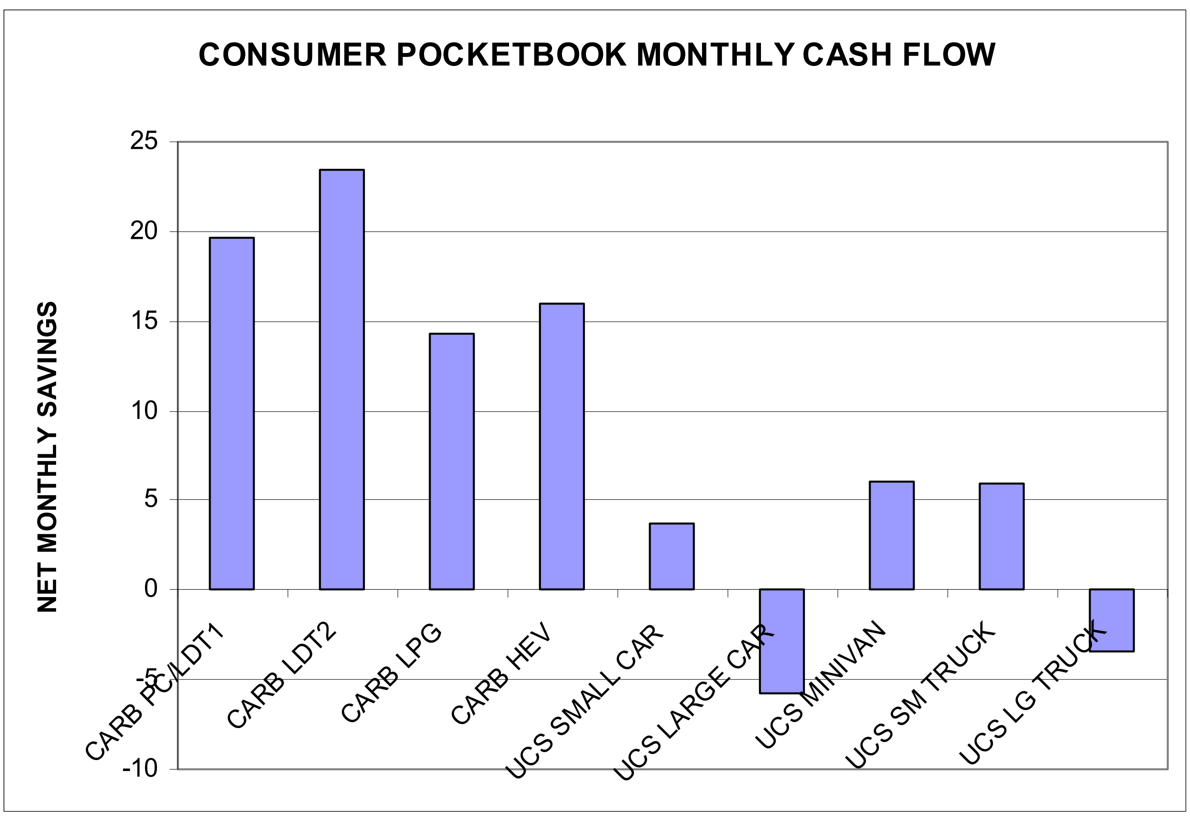
[16] CARB, p. 80, shows that refrigerant leakage reduction equals 1.45 percent of the total.

vehicle. When gasoline prices of $3 per gallon are used, all of the vehicles resulted in positive cash flow.

In these comments, the consumer pocketbook analysis is conducted by taking the increased cost of the vehicle that results from the inclusion of greenhouse gas reducing technologies and adding it to the amount of the auto loan. The loan payment is calculated assuming a five year loan, which is the typical loan period today with a 7 percent auto loan rate.

We find that the savings in operating costs is larger than the increase in the monthly auto loan payment for all of the CARB vehicles and three of the five UCS vehicles (see Exhibit 1). The ethanol component of the UCS vehicles cuts into the operating cost savings because UCS assumed a substantial lower mileage and a narrow price differences. The compliant, conventional fuel vehicles modeled by CARB have positive monthly cash flow of about $20 per month, which is particularly important, as these are likely to be the primary approach to compliance. Moreover, it is important to note that the one category of vehicles not modeled by CARB, minivans, has a positive cash flow in the UCS analysis.

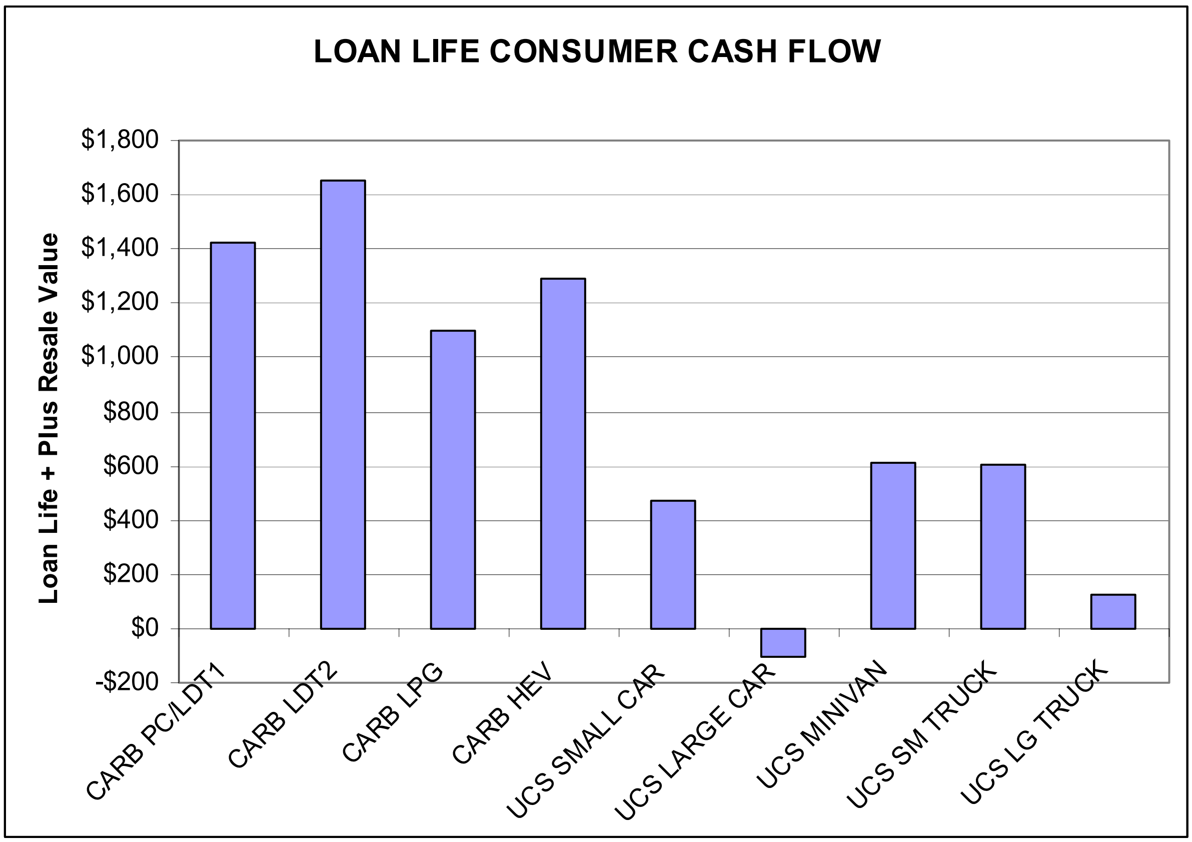
Exhibit 1:



Source: See Appendix A

The consumer monthly cash flow is the primary consumer pocketbook test we use, but the savings can be aggregated. Savings over the life of the loan would be between $500 and $1,000. CARB notes that the resale values of the compliant conventional fuel vehicles are likely to be higher by $250 to $350. As shown in Exhibit 2, at the end of the loan, which is a key moment from the consumer point of view, the net benefit for the CARB vehicles is over $1,000. For the UCS vehicles they are smaller, with four of the five positive. The longer the consumer owns the vehicle, the grater the savings. In fact, savings over the entire life of the vehicle (lifecycle savings) would be two to three times as large, depending on how long one assumes the vehicles will stay in use. An indication of this can be found in the net lifecycle cost savings with fuel costs only, which is part of the societal analysis.

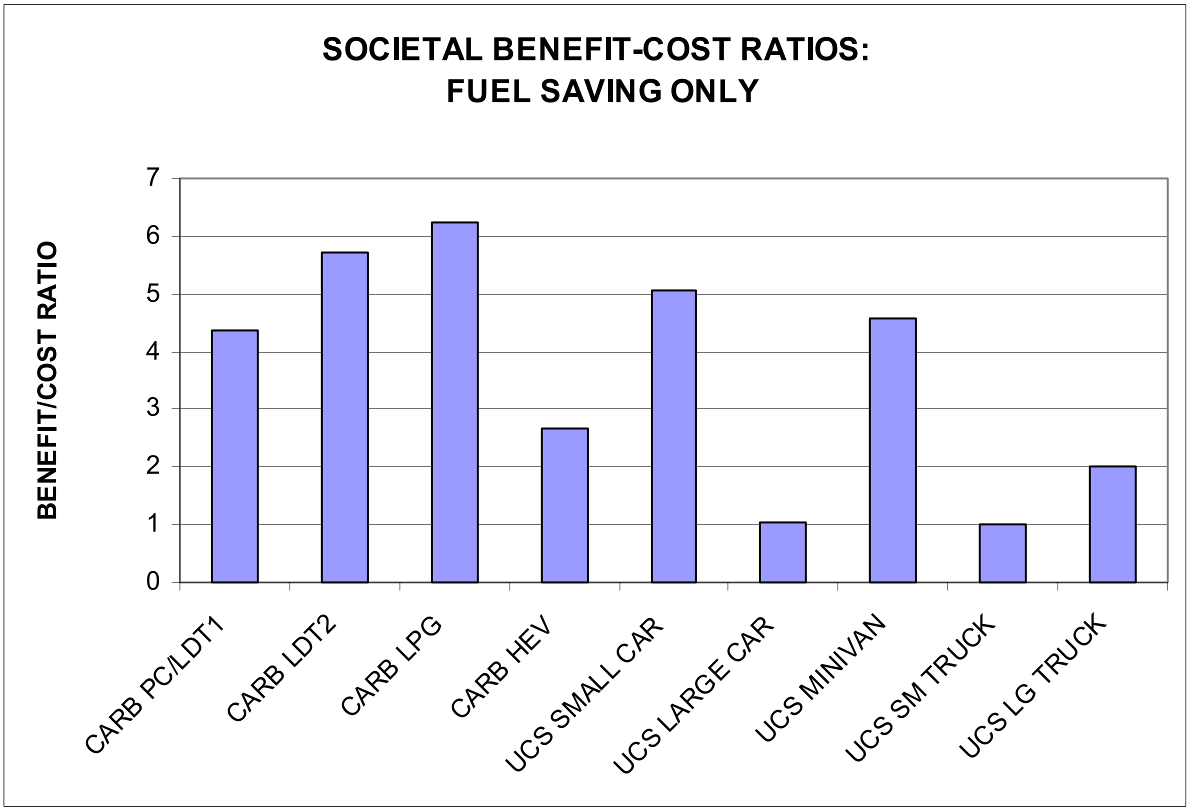
Exhibit 2:



Societal Cost-Benefit

In the original analysis, seven of the eight vehicles had societal benefit cost ratios greater than one, i.e. benefits exceeded costs. In the updated analysis, all of the vehicles have societal cost benefit ratios well above one, even when only fuel savings are included See Exhibit 3). Since the earlier studies did not include external benefits, this analysis with fuel savings only is a simple update of the earlier analysis. This is the equivalent of the societal analysis in the earlier studies.

Exhibit 3:



Source: See Appendix A

When the value of externalities is included, the societal benefit cost ratios become quite large. The CARB vehicles are in the range of 4 to 10. The UCS vehicles sre in the range of 2 to 7.(see Exhibit 4). That is, a dollar of spending on reduces emissions yields 4 to 10 dollars of discounted value over the life of the vehicle.

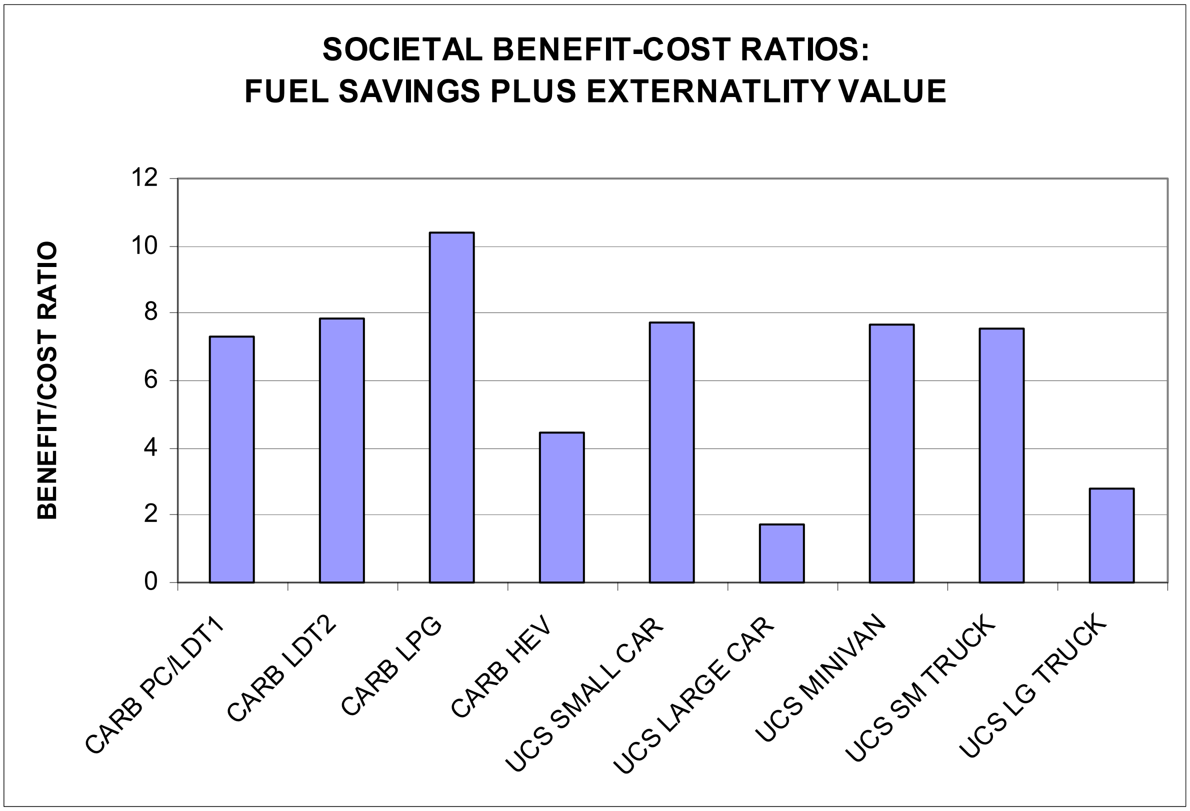
We arrive at this conclusion in the following manner. The monthly operating cost savings is added up over the life of the vehicle and discounted at 7 percent. The discount rate represents the normal return that is available on investment in society.[17] The discounted life cycle savings resulting from reduced emission and energy use are then compared to the cost.

Our finding that the benefits far exceed the costs means that the benefits are in excess of the return that is normally available. Benefits that exceed costs by four to ten times are very attractive. Even this large net benefit is conservative because we assume that the costs are at

[17] This is the reason that we set the discount rate equal to the auto loan rate. It could be argued that a lower discount rate should be applied because average citizens tend to ear less than the auto loan rate on secure investments.

present value and real. That is, we do not discount the costs, no matter how far in the future they occur, but it is entirely possible that the additional cost of the technologies used will decline over time as higher volumes are sold and the manufacturers gain familiarity with the technologies.

Exhibit 4:



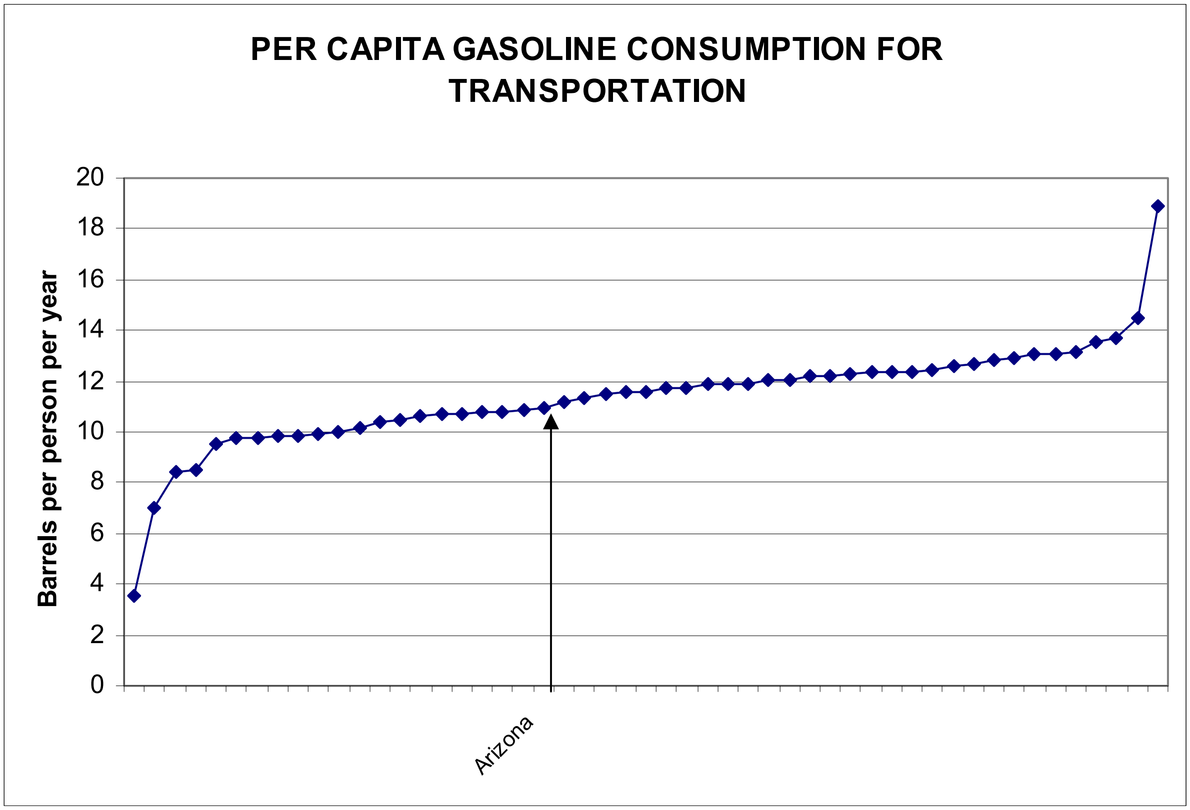
Source: See Appendix A

CONCLUSION

This analysis shows beyond a shadow of a doubt that adopting the clean cars program to reduce emissions of greenhouse gases from vehicles is in the consumer interest. Cash flow for all of the vehicles that would be in compliance is positive from the first month. Societal benefits exceed costs by a wide margin.

The consumer pocketbook test is a direct benefit to consumers in Arizona. The societal benefits flowing from reduced gasoline consumption flow indirectly to consumers. Some of these benefits, like strengthening the state economy by keeping resources within the state, will flow directly to the state. Moreover, while it is hard to tie other benefits like a strengthened national economy or reduced cost of defending the nation's oil supply directly to Arizona, there is no doubt that some will flow to Arizona. Indeed, as shown in Exhibit 4, given that per capita gasoline consumption in Arizona is above the national average, these indirect benefits will flow disproportionately to Arizona.

Exhibit 4:



Source: Energy Information Administration, *State Energy Data* available at [http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_mg.html;Bureau](http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_mg.html) of the Census, *Statistical Abstract of the United States*

In short, we conclude that the California Clean Cars Program should be adopted in Arizona because it would result in substantial economic benefits to consumers in Arizona in addition to the environmental benefits that it provides.

APPENDIX A

This Appendix describes in more detail the economic analysis presented above. Exhibit A-1 lists the elements of the analysis as briefly described in the text. The four estimates from the California Air Resources Broad (CARB) are the bundles of technologies that the CARB found in compliance with the Program. The first two vehicles are based on conventional technology. The second two involve alternative fuels. The five vehicles modeled by UCS involve combinations of hybrid and conventional technologies. Thus the nine vehicles cover a wide range of technologies and costs.

All of the analyses are based on the assumption of 15,000 miles driven per year and assume a current mileage of 24.8 miles per gallon. The implicit monthly consumption of gasoline is 50.4 gallons of gasoline. The fuel savings equivalent varies across the technologies from 3.5 gallons to over 60 gallons.

The economic assumptions also varied across the studies. CARB presented a consumer pocketbook analysis for the two conventional fuel vehicle bundles. That is, it calculated the cash flow assuming an auto loan of five year duration at an interest rate of 5 percent. They also identified the additional resale value that the vehicles would have if they were sold in the fifth year. The analysis focused on the cash flow impact felt by the consumer. This is the approach taken in our pocketbook analysis.

The remaining six vehicles were evaluated with more of a societal approach. They applied a discount rate to the flow of benefits to calculate a payback period, a lifecycle cost saving and a benefit cost ratio. They also include a rebound effect, which is a societal element.

The rebound effect occurs when the consumer finds more money in his or her pocket and chooses to spend that money on more driving, therefore consuming more gasoline. As a result, there is less reduction in greenhouse gases than a simple analysis suggested. This is a societal effect and not a consumer pocketbook effect for the following reason. When consumers find themselves with more money in their pockets at the end of the month, they are better off by exactly the amount of additional money. If they choose to spend it on gasoline, that does not diminish the welfare gain at the consumer level. It does diminish the societal gain in terms of reduced oil imports or reduced greenhouse gas emissions.

It should be noted that the CARB conducted a societal analysis on the individual technologies used to build the compliant conventional fuel vehicles, but then did a consumer pocketbook analysis on the bundle of technologies they chose to use to build a compliant vehicle. That is, they did a "net present value analysis of engine and drive train technologies" (p. 100) for conventional fuel vehicles.

Our strategy is twofold.

First we extract the basic assumptions from the published analyses and complete the full set of "pay-off" analyses, as indicated by the arrows in Exhibit A-1.

Second, we recalibrate the analyses to more contemporary values. We increase the price of gasoline to $3 per gallon. We increase the cost of a five year auto loan to 7 percent, which is available today. To reflect that increase, we increase the discount rate to 7 percent, so the consumer pocketbook and societal cost benefit analysis are using the same interest rate.

We also consider an externality value of $2 per gallon. In the current environment, this is a cautious figure. Economically, the U.S. is exposed on a daily basis to oil price shocks and supply disruptions.[18] Retired Air Force General Charles Wald estimates that if the true cost of military security were incorporated into the price of gasoline, we would be paying between $6.50 and $7 a gallon. The IPCC put the global warming cost of carbon dioxide emissions at the equivalent of $1 per gallon. Our review of the literature shows that these social costs have a value of between $1 and $2 per gallon.[19] Given recent developments, we believe the higher figure is more appropriate.

To calculate the externalities, we use the implicit gasoline savings from the consumer pocketbook analysis as the base. This is conservative for both the compliant conventional fuel vehicles and the alternative fuel vehicles. In both cases, there are emissions reductions not associated with gasoline consumption, which are not accounted for in this approach. Thus, there are environmental benefits the analysis does not credit to the vehicle. For the alternative there are also likely to be additional oil savings to the extent that the alternative fuels consumed do not require the use of oil to produce. This will vary, depending on the alternative fuel used.

This analysis is conservative because of the economic assumptions. We assume a constant real cost of gasoline and a constant real cost of technology. Over the course of the program gasoline are likely to rise in real terms and technology costs are likely to decline as more units with the technology are sold.

Exhibit A-2 shows the results of the analysis. We show the multiple economic criteria for the societal cost benefit test as well as the societal analysis both with and without the externality value.

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[18] David L. Greene and Sanjana Ahmad, *Cost of U.S. Oil Dependence: 2005 Update, 2005* (2005).

[19] See 50 by 2030, citing International Center for Technology Assessment, The Real Price of Gasoline, 1997, Gasoline Cost Externalities Associated with Global Climate Change, September 29, 2004; Gasoline Cost Externalities: Security and Protection Services, January 25, 2005; Lovins, Amory, et al., Winning the Oil Endgame (Rocky Mountain Institute, 2004); Greene, David L., and Sanjana Ahmad, Costs of U.S. Oil Dependence: 2005 Update (Oak Ridge National Laboratory: Tennessee, February 2005).

Exhibit A-1:

ELEMENTS OF VARIOUS COST BENEFIT CALCULATIONS										
BASIC FEATURES										
Author	CARB	CARB	CARB	CARB		UCS	UCS	UCS	UCS	UCS
Date	2004	2004	2004	2004		2007	2007	2007	2007	2007
BASIC ASSUMPTIONS										
Technology	PC/LDT1	LDT2	LPG	HEV		SMALL CAR	,RGE CAR	MINVAN	M. TRUCK	.G TRUCK
						All anallayes include least cost conventional plus E85				
Cost	1064	1029	370	4500		180	543	299	298	670
Annual Miles	15000	15000	15000	15000		15000	15000	15000	15000	15000
Miealge Base	24.8	24.8	24.8	24.8		NA	NA	NA	NA	NA
Consumption Base	50.4	50.4	50.4	50.4		NA	NA	NA	NA	NA
Fuel Savings equivalent	13.57	14.17	6.73	35.03		2.43	1.66	4	3.95	3.29
(Gasoline, gal.)										
Gasoline Price	1.74	1.74	1.74	1.74		2.55	2.55	2.55	2.55	0.255
ORIGINAL CASE										
POCKETBOOK ANALYSIS										
Payment Method	Loan	Loan	Loan	Loan						
Interest Rate	5%	5%	5%	5%						
Loan Period	5 year	5 year	5 year	5 year						
Resale Value	245	329	na	na						
Economic criteria	Cash Flow	Cash Flow	Cash Flow	Cash Flow						
SOCEITAL ANALYSIS										
Discount rate			5	5		5	5	5	5	5
Economic criteria			Payback	Payback		Payback	Payback	Payback	Payback	Payback
Rebound Effect			3.08%	3.08%		3.08%	3.08%	3.08%	3.08%	3.08%
MODIFICATIONS TO RECALIBRATE TO 2007										
POCKETBOOK ANALYSIS										
Gasoline Price	$3	$3	$3	$3		$3	$3	$3	$3	$3
Auto Loan Rate	7%	7%	7%	7%		7%	7%	7%	7%	7%
SOCIATAL ANALYSIS										
Gasoline Price	$3	$3	$3	$3		$3	$3	$3	$3	$3
Externality Value	$2	$2	$2	$2		$2	$2	$2	$2	$2
Discount Rate	7%	7%	7%	7%		7%	7%	7%	7%	7%

Exhibit A-2

COST BENEFIT CALCULATIONS FOR VARIOUS VEHICLE/TECHNOLOGY BUNDLES									
Author	CARB	CARB	CARB	CARB	UCS	UCS	UCS	UCS	UCS
Date	2004	2004	2004	2004	2007	2007	2007	2007	2007
ORIGINAL CASE									
Pocketbook Analysis									
Monthly Cost	$20.08	$19.42	$7.00	$84.93	$3.40	$10.25	$5.64	$5.62	$12.64
Monthly Savings	$23.61	$24.66	$11.71	$60.95	$6.20	$4.23	$10.20	$10.07	$8.39
Net Monthly Savings	$3.53	$5.24	$4.71	-$23.98	$2.80	-$6.02	$4.56	$4.45	-$4.25
Life of the Loan + Resale	$457	$559	$528	-$1,110	$413	-$116	$519	$512	$74
Societal Analysis									
Payback	5	3.8	3	8	1.6	5.2	1.6	1.6	3.7
Net Life Cycle Savings (16 yr)	$2,676	$3,486	$1,161	$3,824	$629	$9	$1,034	$1,019	$426
RECALIBRATE TO 2007									
Pocketbook Analysis									
Monthly Cost	$21.07	$19.01	$5.94	$89.11	$3.56	$10.75	$5.92	$5.90	$13.27
Monthly Savings	$40.71	$42.51	$20.19	$105.09	$7.29	$4.98	$12.00	$11.85	$9.87
Net Monthly Savings	$19.64	$23.50	$14.25	$15.98	$3.73	-$5.77	$6.08	$5.95	-$3.40
Life of the Loan + Resale	$1,423	$1,655	$1,100	$1,288	$469	-$101	$610	$602	$125
Societal Analysis									
Fuel Savings Only									
Payback	2.3	2.2	1.5	4.2	2.2	14.3	2.2	1.3	7.4
Net Life Cycle Savings (16 yr)	$3,583	$4,851	$1,935	$7,495	$729	$25	$1,071	$1,054	$454
Total Benefit/Cost Ratio	4.37	5.71	6.23	2.67	5.05	1.05	4.58	4.54	1.68
Fuel Savings + Externality Value									
Payback	1.4	1.3	1	2.3	0.8	2.5	0.8	0.8	1.8
Net Life Cycle Savings (16 yr)	$6,681	$7,058	$3,470	$15,492	$1,207	$404	$1,984	$1,956	$1,208
Total Benefit/Cost Ratio	7.28	7.86	10.38	4.44	7.71	1.74	7.64	7.56	2.80