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I. Introduction

Americans and their policy makers are increasingly recognizing the environmental and economic impacts of America's reliance on the automobile.[1] The most successful and developed policy remedies to these impacts—improved fuel efficiency standards and gasoline taxes—are bogged down in a political impasse. As a result, complementary approaches are being designed in an effort to develop a package

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1. For a full discussion of these impacts and estimates of the damage they cause, see Charles Komanoff & Brian Ketcham, Win-Win: Transportation: A No-Losers Approach to Financing Transportation in New York City and the Region (July 1992) (unpublished manuscript, on file with Komanoff Energy Associates) and PETER MILLER & JOHN MOFFET, NATURAL RESOURCES DEFENSE COUNCIL, THE PRICE OF MOBILITY: UNCOVERING THE HIDDEN COSTS OF TRANSPORTATION (Oct. 1993).

of options that will make standards and taxes more palatable. Some of these new options rely primarily on market-based incentives aimed at sending the right price signals for vehicle-miles-traveled (VMT). However, the two programs described in this paper, Demand Based Reduction in Vehicle Emissions Plus Increased Fuel Economy (Drive+) and the Dealer Scrappage Program, use direct financial incentives to influence consumer technology choices.

These programs are designed to promote retirement of the least efficient automobiles and light-duty trucks and to encourage the purchase of cleaner, more efficient vehicles. They recognize that for the foreseeable future, the personal automobile will continue to play a major part in American transportation. Though both programs could be implemented in any state and on the federal level, the specifics discussed herein were developed with New York in mind.

II. The Setting

The Clean Air Act Amendments of 1990 (CAAA)[2] and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)[3] represent the widest acknowledgments yet of the environmental impacts of America's reliance on the automobile. These two pieces of legislation contemplate a major shift in the focus of state transportation planning away from automobiles and highways to a fuller array of alternatives, including public transportation, ride-sharing, walking and cycling.

Unfortunately, the Corporate Average Fuel Economy (CAFE) standards[4] and the federal gasoline tax, which have produced the greatest increases in vehicle efficiency since the 1970's, are now dividing decision-makers. A standoff has formed between the environmental community and the automobile industry. Environmentalists have supported increasing CAFE standards and gasoline taxes, while the industry

2. Pub. L. No. 101-549, 104 Stat. 2399 (1990) (codified as amended at 42 U.S.C. §§ 7401-7671q (1988 & Supp. V 1993)).

3. 49 U.S.C. §§ 5501-5907 (1988 & Supp. V 1993).

4. The CAFE program was established in Title V of the Motor Vehicle Information and Cost Saving Act, 15 U.S.C. §§ 2001-13 (1988 & Supp. V 1993).

has opposed CAFE but generally supported gasoline taxes. The result has been increases in gasoline taxes that are too small to have an impact on automobile efficiency and a stalling of CAFE standards at mid-1980's levels.[5]

Within the last few years, the CAAA, ISTEA and the leadership shown by California have increased the policy options. However, the standards laid out in the CAAA and in California's Low Emission Vehicle (LEV) program[6] are meeting the same resistance from the automobile industry that CAFE is. The LEV standards are already being challenged in every state that has adopted them, including California.[7]

Environmental advocates must therefore develop a broader set of policy tools so that emissions reductions and efficiency gains become politically viable. These policies should also provide incentives to make improvements beyond the mandated standards. The most promising approach relies on packaging market-based incentives that adjust the price signals sent to consumers, which would provide the automobile industry with economic incentives to achieve environmental policy goals. Smog fees that increase registration charges on vehicles which produce high pollution levels are an example of adjusting automobile pricing by internalizing the cost of emissions. Other examples include congestion pricing measures, such as peak and off-peak toll pricing, and "pay-as-you-drive" insurance which would link insurance premiums to the number of miles driven.[8]

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5. CAFE standards for passenger cars reached a high in 1985 of 27.5 miles per gallon only to be rolled back to 26 in 1986. Only in 1990 did the standard reach the 27.5 level again. JAMES J. MACKENZIE & MICHAEL P. WALSH, WORLD RESOURCES INSTITUTE, DRIVING FORCES: MOTOR VEHICLE TRENDS AND THEIR IMPLICATIONS FOR GLOBAL WARMING, ENERGY STRATEGIES, AND TRANSPORTATION PLANNING 22 (Dec. 1990).

6. *See* CAL. HEALTH & SAFETY CODE §§ 43800-806 (West 1986 & Supp. 1994).

7. Mark Rechtin, *Big 3 See Delay in '98 Calif. EV Edict*, AUTOMOTIVE NEWS, Nov. 22, 1993, at 1, 34.

8. For a more complete discussion of fees on the harms caused by driving, see TRI-STATE TRANSPORTATION CAMPAIGN, CITIZEN'S ACTION PLAN (Apr. 1994) and Komanoff & Ketcham, *supra* note 1. The Tri-State Transportation Campaign can be reached at the Environmental Defense Fund's offices in New York.

III. Drive+ and Dealer Scrappage

Fees and pricing measures such as those described above, would increase the price of driving, especially at certain peak periods. The Drive+ and Dealer Scrappage Program focus instead on ensuring that the automobiles on the road today are cleaner and more efficient.

A. Drive+: How It Works

Under Drive+, which has been introduced twice in the California legislature, new automobiles and light-duty trucks sold would be assigned either a fee or a rebate at their point of sale, based on their emissions and efficiency relative to the new-vehicle fleet average.[9] This provides both a "stick" and "carrot" to improve the efficiency and emissions of new vehicles.

The fee or rebate assessed would be based on the difference between the emissions of the automobile or light-duty truck purchased and the new-vehicle fleet average emissions[10] of carbon monoxide (CO), hydrocarbons (HC), nitrous oxides (NO_x), and carbon dioxide (CO_2); both in its capacity as a greenhouse gas, and as a gauge for efficiency), measured in grams per mile. For each criterion, the difference is multiplied by a dollar per gram per mile value, which represents the cost of those emissions to society.[11] The total rebate or fee a vehicle receives represents a sum of the rebate or fee for each pollutant emitted, and thus measures the vehicle's over-

9. The most recent version of the "Demand-based Reduction in Vehicle Emissions (Plus reductions in CO_2)," or Drive+, program was introduced as Cal. S. 378, Reg. Sess. (1993) by Senator Hart on Feb. 23, 1993.

10. The averages for these criteria are based on EPA's new and 50,000 mile certification data for all cars and trucks manufactured. The average must then be weighed according to projected sales to produce a projected new-vehicle fleet average.

11. Determining the societal costs of pollution is an analytically challenging process. However, while the incentives should be based on the societal cost, much of the desired effect can be achieved with values that are chosen politically. California Senate Bill No. 378 proposed initial values of $1925 per gram per mile of HC, $2200 per gram per mile of NO_x, $220 per gram per mile of CO, $2.50 per gram per mile of CO_2, and $586 per gram per mile of particulates. Cal. S. 378, Reg. Sess. (1993). This would result in about a $3000 range in fees and rebates, for all vehicles considered.

all emissions and efficiency performance. By changing the value assigned to the different criteria, a state can weigh the importance of the emissions relative to each other. Furthermore, by adjusting the size of the fees collected relative to the rebates, the program could be revenue neutral and avoid the stigma associated with new tax proposals.

Drive+ works on two levels: it makes cleaner, more efficient vehicles more affordable to buy, and makes them more profitable to sell. To maximize both of these effects, Drive+ would best be implemented at the federal level. However, even at the state level, initial modeling by Lawrence Berkeley Laboratories (LBL) shows Drive+ could reduce emissions of HC, NO_x, CO_2 and CO from new automobiles and light-duty trucks by as much as 3.5% in the first year through consumer response alone.[12] This analysis assumes that incentives would range from a $1750 fee to a $1200 rebate and that consumers are choosing more efficient vehicles from those currently available.[13] Further modeling by LBL suggests that the manufacturers would have a much greater impact on the reductions in emissions by improving their model lines.[14]

The combined impact could be particularly significant if Drive+ is implemented on the federal level or in a few large states such as New York, which accounts for between 6 and 7% of new automobile sales nationwide. The LBL modeling suggests that Drive+ could play an important role in state efforts to meet CAAA requirements.[15] Similarly, the incentives would help reduce reliance on imported oil. In addition,

12. Memorandum from William Davis, Energy Analysis Program, Lawrence Berkeley Laboratory, to Lew Fulton 1 (Dec. 23, 1992) (on file with author).

13. *Id.* at 4.

14. WILLIAM DAVIS ET AL., ENERGY ANALYSIS PROGRAM, LAWRENCE BERKELEY LABORATORY, THE DESIGN AND IMPACTS OF FEEBATES 9-11 (Sept. 1994). This modeling showed an increase in new vehicle efficiency for cars of between 12 and 18% and for trucks of between 10 and 13% by 2010. This results in a cumulative savings from 1995-2010 of between 660 and 890 million tons of CO_2 emissions and between 66.7 and 89.9 billion gallons of gasoline. *Id.* at 14.

15. *Id.* at 1.

cleaner air and more efficient vehicles mean savings to consumers through reduced medical and fuel bills.[16]

In basing the total incentive on the sum of the differences within each criterion, Drive+ challenges the popular notion that increases in efficiency and reductions in emissions are antithetical. There are two reasons for believing that the incentives for efficiency will not be canceled out by those for emissions. First, emissions control technology is improving. Even now, any one pollutant can be controlled to almost any level if cost is not considered. Second, vehicles on the market already generally adhere to the rule "less fuel in—less emissions out."

The accuracy of this rule can be seen by grouping vehicles by their efficiency and studying the average emissions for each group. As predicted, vehicles in the more efficient groupings have lower average emissions and the less efficient groupings have higher emissions.[17] The only pollutant that does not currently adhere to this rule is nitrogen oxide emissions from automobiles.[18] The accuracy of this rule is further evidenced by comparing car emissions averaged over efficiency groupings to truck emissions. Emissions controls for trucks have received much less emphasis than controls for cars. Therefore emissions from trucks more closely represent the emissions of different engines without the variations caused by different control technologies. By looking at the emissions by efficiency grouping for trucks, a better picture emerges showing how emissions relate to fuel consumption absent controls. As predicted, more efficient trucks have much lower emissions than less efficient trucks for all pollutants including nitrogen oxide.[19] Conversely, because emissions from car engines are more controlled, the relationship between car emissions and efficiency is weaker.[20]

16. A draft report on more modeling done by LBL predicts that fees and rebates done at the federal level and designed solely to increase efficiency would produce an increase in consumer surplus of $70-91 per household per year in 2010. *Id.* at 14.

17. See figures 1-4 and 6.

18. See figure 5.

19. See figures 2, 4 and 6.

20. See figures 1, 2 and 5.

Drive+ has two further advantages as a policy option. First, Drive+ would work well with the California LEV program, which is the only set of emissions standards that states are allowed to adopt other than the federal ones.[21] The LEV program sets average fleet emissions standards for a variety of pollutants. Since Drive+'s incentives are based on the fleet average, the Drive+ program will continue to push and pull the market even when LEV goes into effect. Second, since Drive+ is a variation on states' existing motor vehicle tax and registration fee policy and does not set standards, the program should not run afoul of the federal preemption of state fuel efficiency standards.

B. Dealer Scrappage: How It Works

The Dealer Scrappage Program has two goals: to encourage retirement of the most inefficient and polluting vehicles and to ensure that the vehicles which replace the retired ones are as clean and efficient as possible. Calculating one incentive to achieve both these goals is challenging, even in theory, and requires extensive data. For this reason, the program is primarily envisioned for parts of the country where enhanced inspection and maintenance (I/M) is federally mandated and can provide more complete data on the existing fleet. The incentive, or "scrappage bounty," would be offered to dealers only on trade-ins that fail to meet local emissions requirements, contingent upon those trade-ins being scrapped. Furthermore the bounty would be based, in part, on the difference in emissions between the trade-in and the replacement vehicle, thus encouraging dealers to sell the cleanest automobiles and light-duty trucks possible.[22]

Policy makers should realize that the Dealer Scrappage Program, still in its initial development stage, would not encompass the ideal scrappage candidate: a passenger vehicle owner who drives a dirty gas-guzzler but who would be will-

21. *See* 42 U.S.C. §§ 7582-84 (1988 & Supp. V 1993).

22. The concept for a bounty based on the difference between a trade-in and new purchase was originally proposed by Amory Lovins of the Rocky Mountain Institute.

ing to retire it and start using alternative transportation.[23] However, the proposal does address two major problems posed by scrappage programs which offer a fixed bounty for all vehicles. Simple scrappage programs with one fixed bounty would encourage people to retire back-yard junkers that had already been removed from the road. Though these junkers may theoretically have high emissions per mile, the total emissions cost society less than the bounty, since they are not being driven. The Dealer Scrappage Program solves this problem by making the bounty proportional to the annual mileage of the trade-in during the most recent year.

Even if a simple scrappage program sets the fixed bounty equal to the average annual emissions savings based on the average vehicle predicted, this program would also tend to over-estimate the actual reductions and thus pay too much. This error occurs if participants in the program replaced their scrapped vehicles with other heavy polluters, thus minimizing the net reductions. By basing the bounty in part on the difference between the trade-in and the replacement, the bounty in the Dealer Scrappage Program is proportional to the emissions savings that actually occur.[24]

The bounty would be calculated as the dollar value to society of the difference in annual emissions, including CO_2 as a surrogate for efficiency, between the trade-in and the vehicle sold. The value of the emissions would be calculated on a grams per year basis which requires multiplying the emissions per mile by miles driven per year. The miles driven per year would be determined by the annual miles driven in the trade-in. For example, if a person trades in a vehicle with emissions with a cost to society of $1750 and replaces it with a car that if driven the same amount as the trade-in would have emissions worth $750, then the bounty would be $1000.

The bounty would be capped, however, at the total cost of the repairs which would be required to bring the trade-in into

23. Ideal modes of alternative transportation which would not produce additional air pollutants include mass transit, cycling or walking.

24. Marika Tatsutani, Energy & Resources Group, University of California at Berkeley, Unocal Corporation's SCRAP: An Experiment in Corporate Environmental Initiative 41-47 (May 1991).

compliance with local emissions standards. Thus if the emissions worth $1000 could be eliminated through $500 worth of repairs, the bounty would be $500. On the other hand, if the repairs would cost $1500, the bounty would stay at $1000. The final adjustment to the bounty is to exclude the cost of any repairs mandated by law. Thus, continuing our example, if the repairs could be made for $500, but in New York the I/M program mandated expenditures up to $450, the bounty would only be $50.

If a dealer thought he or she could resell the trade-in for more than $500 (the bounty plus the required expenditure on repairs) then the dealer presumably would not accept the bounty. But if the vehicle's value was less than $500, the bounty would sway the dealer to scrap the vehicle, saving society $1000 worth of emissions.[25]

While the formula for the bounty — the lesser of either the societal value of the difference in emissions or the cost of repairs — is relatively simple, collecting the required information presents dilemmas. For example, the annual miles driven in the trade-in and the emissions per mile of both the trade-in and the replacement must be recorded. While this data could be collected in some areas through enhanced I/M, the program would need to guard against the large potential for fraud. Two less easily solved problems are determining the total cost of repairs and the societal cost of emissions. Determining the cost of repairs raises the problem of potential tampering with emissions controls to increase the bounty or preset values for different types of repairs that are imprecise and inflexible. Determining societal values is both a politically and analytically daunting task.

IV. Conclusion

Drive+ and the Dealer Scrappage Program are at different stages of development in New York. The Dealer Scrappage Program still needs input from experts on automobile emissions, enhanced I/M, and the used-car market to help define important administrative components and data require-

25. Figure 7 offers a decision tree for the program.

ments. Both programs also need state specific modeling. The modeling will be vital to adjusting the value attached to cleaner more efficient vehicles in the future and to assessing the impacts on emissions to be counted towards CAAA requirements. However, legislatures need not wait for this modeling to implement these programs. We know that the value of these emissions is measurable, and even small fees and rebates will provide the right financial incentives.

These two policy options promise real reductions in wasted fuel and emissions and, as part of a larger package, a way to break the current policy gridlock. While CAFE, LEV, and gasoline taxes have a crucial role to play, the pace of change will increase only by broadening the options available to policy makers.

Figure 1

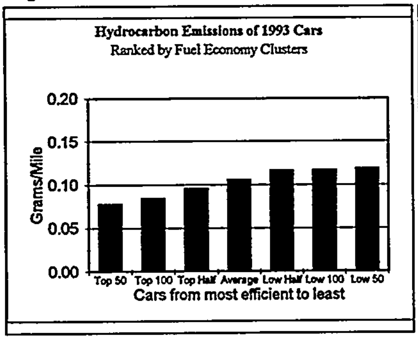


Figure 2

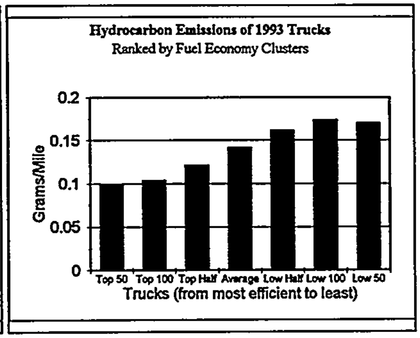


Figure 3

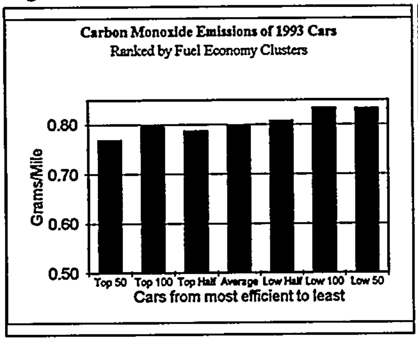


Figure 4

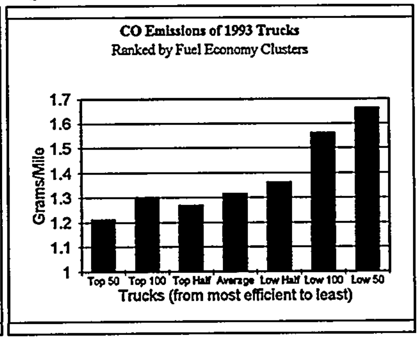


Figure 5

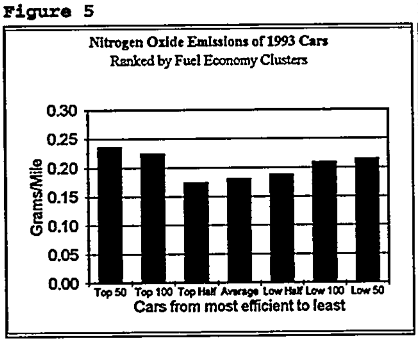


Figure 6

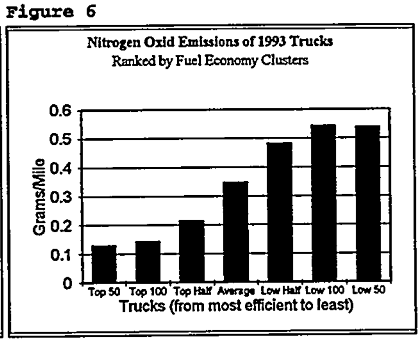
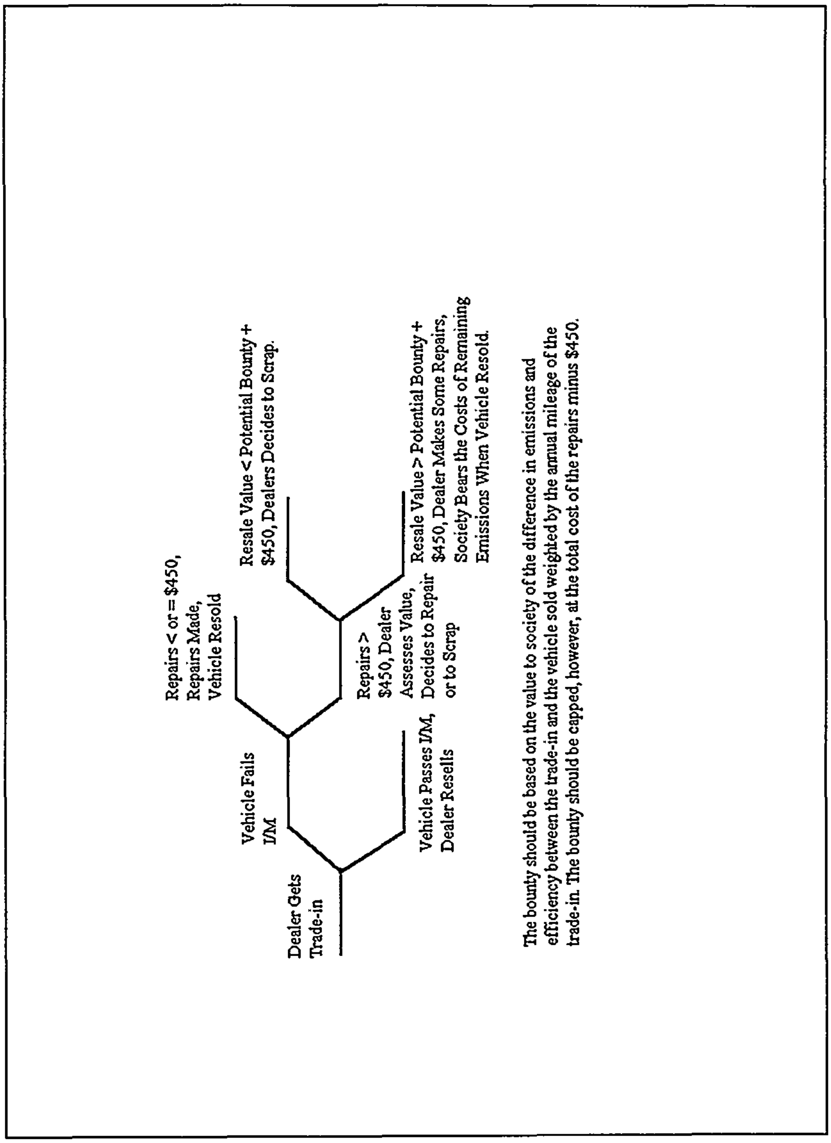


Figure 7


Dealer Gets Trade-in
Vehicle Fails I/M
Vehicle Passes I/M, Dealer Resells
Repairs < or = $450, Repairs Made, Vehicle Resold
Repairs > $450, Dealer Assesses Value, Decides to Repair or to Scrap
Resale Value < Potential Bounty + $450, Dealers Decides to Scrap.
Resale Value > Potential Bounty + $450, Dealer Makes Some Repairs, Society Bears the Costs of Remaining Emissions When Vehicle Resold.
The bounty should be based on the value to society of the difference in emissions and efficiency between the trade-in and the vehicle sold weighted by the annual mileage of the trade-in. The bounty should be capped, however, at the total cost of the repairs minus $450.