Chapter 22

GOVERNMENT POLICIES

1. Summary

This *Technical Annex* details our analyses and conclusions on feebates, low-income scrap-&-replace programs, and government procurement. Please see Chapter 21 of the *Technical Annex* for a detailed description of our Light-Vehicle stock and flow model.

2. Feebates

Historical Background

Feebates have been widely considered but little used. A feebate program was attempted in Maryland, but blocked by federal regulation[i]. Feebates were also passed by the California legislature by a 7:1 margin in 1990[ii], but were blocked by then-governor Davis. Feebate programs have also been implemented, or are very close to being implemented, in a number of countries. The French Ministry of Environment is presently very close to finding legislative acceptance for a nationwide feebate program[iii]. After an extensive and inclusive stakeholder negotiation, feebates were approved in Ontario, Canada[iv], and Austria has also implemented feebates[v].

Austria has also implemented a tax system known as "NOVA" (Normverbrauchsabgabe). This system was introduced in 1992, prior to which the tax rate on new vehicles was 32 per cent. The tax on a gasoline vehicle with fuel economy of 8 L/100 km is unchanged. New vehicles with lower fuel economy pay less tax than before the change, while vehicles with higher fuel economy pay more tax: up to 10 L/100 km for gasoline cars, 9 L/100 km for diesel. The maximum level of the tax is 37 per cent of the vehicle pretax price. This tax provides an incentive to improve fuel economy only in the range where the tax rate varies with fuel economy (i.e., below 10 L/100 km for gasoline cars, 9 L/100 km for diesel cars). Various incentive programs along the lines of rebate- and tax-systems have also been introduced in Denmark, Germany, and Sweden.

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[i] A good www overview is at http://sol.crest.org/efficiency/energywise_options/index.html; see Chapter II, part 4.

[ii] See footnote 9 at http://www.ilsr.org/ecotax/greentax.html

[iii] See "France launches radical green tax on bigger cars", The Guardian, 23 June, 2004, Available online at http://www.guardian.co.uk/france/story/0,11882,1245187,00.html. See also "French road tax rattles gas guzzlers," *Financial Times*, 3 July 2004.

[iv] See http://iisd1.iisd.ca/greenbud/taxfuel.htm and "Ontario's Automobile Feebates," in http://www.ilsr.org/ecotax/greentax.html.

[v] Michaelis, 1997, "CO2 EMISSIONS FROM ROAD VEHICLES," Annex I Expert Group on the United Nations Framework Convention on Climate Change Working Paper No. 1, OCDE/GD(97)69, Part 1, p. 32. Available online at http://www.virtualcentre.org/en/dec/toolbox/Indust/gd9769.pdf

Please see pages 186–190 of the report for a description of how feebates work and our recommendations for their implementation.

3. Federal low-income scrap-and-replace program

Summary

Our second policy initiative addresses three distinct but related problems: lower-income Americans' limited personal mobility (part of the "poverty trap") and associated disproportionate share of income that goes towards fuel costs and pollution creation, their inability to gain from (or contribute to) the prompt benefits of transforming automaking, and the slow (~14-y) spontaneous turnover of the nation's light-vehicle stock.

For this policy initiative we outline two similar mechanisms for addressing this set of problems. Either mechanism involves coast-to-coast scrappage of qualified cars in accordance with best practice for implementing such programs[2]; creates a profitable new million-vehicle-a-year market where none now exists to replace the scrapped cars; increases oil savings and pollution prevention; and yields important equity and social welfare benefits. The two only differ by which used-car buyer segment it targets—one targets the most marginal used car buyers (those that can barely afford a used car), the other targets the least marginal such buyers (i.e., those that buy first-generation used cars). We reserve judgment as to which would achieve the greatest social welfare benefits, and we strongly recommend that the U.S. Government Accountability Office (GAO[3]) or its equivalent determine the most appropriate mechanism and its final form, and that its recommendations be based primarily on which of the two would probably provide the greatest social welfare benefits.

The first version of this policy mechanism, outlined in more detail below, would address all three problems in that it scraps qualified inefficient cars, saves fuel and reduces pollution, and provides efficient mobility in the form of new cars to non-creditworthy low-income customers. For implementation, this version of the policy would involve a federal public office, likely the U.S. General Services Administration (GSA[4]), to bulk-buy and lease, using a multi-stage approach concluding at a nationwide scale, very efficient new vehicles to presently non-creditworthy low-income customers. The office would also qualify low-income individuals for the program, and would oversee scrapping a slightly smaller number of older, less efficient, more polluting vehicles than the number of new cars it procures for the program. For maximum flexibility we propose not to link the financing of the new vehicle to whether the person is in a position to scrap a qualified car, although we recommend exploring this link as an option.

Also outlined more fully below, the second version of the policy mechanism again addresses all three problems. However, due to a very different implementation, its outcome would be to provide efficient mobility in the form of efficient new cars to customers whose present credit record marginally disqualifies them from purchasing a new car. It would involve scrappage in the same way as above, and by again retaining the demand-supply balance in the used car market, it would this time result in quality-improvements to all used-car buyers rather than the lowest-income buyers. This option

would simply guarantee reimbursement to current auto lenders for defaults on loans made to the marginal next-in-line borrower category, and would only reimburse loan defaults that are incremental to that of the highest-default customer segment absent any reimbursement guarantee. This option would therefore almost exclusively involve existing market mechanisms and financial institutions, and the cost would largely consist of reimbursing the incremental defaults. Moral hazard would be minimized via ensuring certain disclosure requirements relating to an individual lender's historical lower threshold for making credit available and via the ability to confidentially compare thresholds across multiple lenders.

In terms of program design we have primarily recognized the market barriers arising from the potentially regressive effect from vehicle scrappage as well as from the information disparity between the technical world of vehicle fuel economy and the vehicle consumer. As such, we do not regard it a primary function of the program design to support RD&D and market transformation, although implementation of the program would have such support as significant additional benefits. This design, however, primarily tackles the market barriers inherent in the present market structure. In so doing, it has sought to design two policy options that both pass four major tests. The general policy and its two options seeks to:

1. Make use of existing markets, institutions, and processes. In competitive environments, such as in the U.S., this tends to lead to cost effective and efficient results.
2. Ensure that sales occur due to the policy and so that the market barriers are overcome. The policy does not cause sales to occur merely because sales are 'purchased' due to generous buyer subsidies—all buyers face incremental costs.
3. Lead to an evolution of sustained and unsubsidized markets. A more rapid high-efficiency vehicle inducement into the low-income used-car market occurs relative to the baseline, with important equity effects in the used-car market.
4. Enhance the possession and usage of relevant information by buyers and sellers. In this case, (relatively technical) criteria around fuel efficiency are fundamental to the type of vehicles considered.

After detailing how the scrappage program would work, we explain why providing mobility to low-income earners will have important knock-on benefits. Finally we describe the two mechanisms in more detail.

Scrappage

The scrappage-portion is identical in both the two mechanisms, so we detail this first. Scrappage programs have been studied and evaluated in detail elsewhere, with important lessons learnt[5]. "Cash for Clunkers" programs that pay customers or bounty-hunters to scrap old-but-still-driven cars according to a carefully detailed set of qualifications have been implemented or considered in at least five states (AZ, CA, DE, IL, ME) and about a dozen other countries, mostly paying ~$500–1,500 and meant to reduce local air pollution.[6] So far, most of these efforts have been on a sufficiently modest scale not to

dry up the clunker supply and make older used cars unaffordable to those who most need their mobility. However, a successful large-scale scrappage effort could in principle have a slightly regressive effect,[7] chiefly on minorities and low-income rural residents.[8]

One offsetting effect to this regressivity is that when leased cars are recycled into the used car market, in the leasing model, they tend to be sold at a price below what would have been the case if they had been pre-owned rather than pre-leased. This will result in a decline in used-car prices, and therefore tend to partly offset the regressivity-effect of scrappage.

A second offsetting effect is the estimated ~1:1.2 ratio of inefficient old cars scrapped to efficient new cars financed. Such a ratio would altogether avoid regressivity at the low end of the used-car market by not scrapping one additional used car for every eleventh new car bought.[9] The twelfth car is inserted into the equation to offset an entirely separate regressivity effect, than from feebates. Please refer to footnote 11 for a full discussion of the rationale behind the ratio.[10] The ratio will also aid market entry by households that did not previously own cars—a fraction that's been declining but in 1999 still included 27% of households below the poverty line.[11] The ratio also ensures market entry by previous non-car-owners, although the ratio may have to be adjusted closer to 1:1 if saturation in the low-income segment would occur.

The effect of this program is to make generally available the same or greater personal mobility to all citizens. Low-income earners would see lower automotive operating costs and higher quality and more reliable personal mobility. Automakers would sell a million additional vehicles a year to this new customer class and make a profit on every sale.The guaranteed offtake would lower the autoamakers' risk of developing new fuel-efficient platforms. Initially, however, the lease-and-scrap program adopts *Conventional Wisdom* vehicles because of their much lower cost and early availability; later, the program could shift to *State of the Art* cars as their price premium diminished.

A final question around scrappage is whether it should be a time-delimited policy—should it have a 'sunset'-provision, such as those clauses that generally phase out policies designed to help infant industries? Since scrappage would need to qualify cars based on the 'Reasonably Reliable Test'[12], and since such cars will be available for a long time to come (given the constancy of fuel economy over the past 20 or so model years), we see little reason for sunsetting the scrappage policy during our forecasting period (2025). As a result, the vehicle replacement financing policy should probably remain in operation over this period as well. Moreover, sound scrappage policy-making would involve applying the 'Reasonably Reliable Test'[13]. Since scrappable cars can always be identified, there appears from the literature to be little reason to sunset scrappage programs. In effect, what we are proposing is sending about 7% of a given cohort to the grave, so that by 2025 some 1518 M cars would be prematurely retired, out of a baseline pool of ~130140 million cars that would not survive anyway. This would indicate that it would be reasonable to retain a coast-to-coast scrappage program until 2025 before reevaluating its existence. We therefore model the program as existing until

2025. We would also recommend that the program reimburse each owner with the Blue Book value of the car being scrapped.

Procuring and financing new cars for marginal used-car buyers

In addition to scrappage, our first mechanism has two major pieces to it: financing and high-volume procurement. Both would be executed by the same agency, such as the Department of Transportation, or more likely the General Services Administration (GSA). On the financing side, GSA would set up an office to qualify the lowest-income segment in need of mobility for a lease on an efficient new automobile. It would finance ultra-low lease rates via large-scale procurement and via careful recognition of five additional benefits of efficient and new cars. The biggest benefit—analogous to the "CostCo discount effect"—arises from GSA's procurement activity, enabling bulk purchase discounts otherwise not available to new car purchasers. Five smaller but important factors also provide financial backbone to the deal, and these are represented by future saved fuel, two emissions credits, cheaper insurance via bulk purchase, and avoided future purchases of replacement clunkers. Bulk purchase of price-hedged gasoline is also possible, but we have not valued this here.

The program should be based on the same principles as and lessons learnt from many other successful demand aggregation-and-procurement programs that have been done over the past 15 years in a very large number of other sectors, both in the U.S. and elsewhere (see details on this, p. 12 of this chapter)**.** In essence, GSA would act as a large-scale aggregator of expressed customer demand for reliability and efficiency. It would buy a large number of new cars that satisfy carefully specified efficiency-related as well as non-efficiency-related characteristics. This would enable GSA to lower the price faced by their target retail customer segment, i.e., the qualified low-income customers. Additional avoidance of fuel costs, emissions, and future replacement clunkers enable low-income buyers to obtain an efficient new car for an incremental cost of between $0.15 and $2.30 per day (see tables 22–1 and 22–2).

Market actors could turn this opportunity into a profitable leasing enterprise. Just as rental fleets now buy new cars in bulk from automakers, lessors could bulk-buy very efficient cars at a competitively negotiated price including a fair unit margin. Lessors could also bulk-buy insurance and even price-hedged gasoline (purchasable by a special credit card, like those used by FlexCar, that's usable only with the leased vehicle and is electronically cancelled in the event of fraud or default). The new car's high efficiency raises the incentive not just to sell a car, but to lease a mobility service solution where lessor and lessee share the benefit of the fuel savings.[23]

We analyzed an illustrative five-year lease, at GSA's federal cost of money, that can get a low-income family into a very efficient (*Prius*-class) new compact or lower-midsize sedan for ~$170-$210/month, including title, registration, and comprehensive and own-vehicle collision insurance. This lease payment avoids $52/month of fuel cost (at $1.50/gal), $84/month (2000 $) for buying a series of breakdown-prone, inefficient used

cars,[25] and $16/month for maintaining them. But the net lease cost of $38/month gains unexpected and almost certainly larger benefits for participants.

We assume procurement cost of $11,492 for *CW* and $13,882 for *SOA* cars per vehicle (2000 $), including OEM profit margin, dealer profit margin, and destination charges; assuming constant average driving of 12,950 mi/y and constant over time. For comparison, in FY2002, GSA purchased 15,038 cars (of various sizes) at an average price of $12,237 (2000 $), but we don't know if that included destination charge. We also assume a baseline $1.50/gal retail price of gasoline that would get a $0.45/gal Pay-at-the-Pump insurance premium added to it, and feebate rates of $1,000/0.01 gpm and $2,000/0.01 gpm respectively. See tables 22–1 and 22–2 for details.

This program would buy more-efficient cars, in large numbers, and probably in a single model. Most lease programs require comprehensive and collision insurance in order to provide coverage in the event of physical damage to the automobile. We assumed that low-income owners of older, used cars do not typically carry this type of insurance coverage, and added $583/y as an incremental cost (GEICO quote for a 2004 Toyota *Prius*), less an assumed 30% markup by insuring at wholesale rates. We do not assume a price premium for insurance coverage (e.g., theft) because electronics-rich modern hybrids like the keyless *Prius* are very difficult to steal, relatively hard to resell illegitimately, and, easy to equip with GSM transponder and remote-shutoff systems, for a small incremental cost. Third-party collision liability insurance would be bought at the pump, as explained at p. 218–219 of the report.

The average bottom-quintile-income family spent $1,048 on used car purchases in 2002.[27] Also from the Bureau of Labor Statistics database query, the average bottom-quintile-income family spent $318 in 2002 on vehicle maintenance and repairs, while the projected repair costs not covered by warranty for a 2004 Toyota *Prius* averaged $113/y[28]. A new car's warranted reliability makes it easier to get and hold a job, and by spending less time on or waiting for slow public transportation, workers may gain more family time which could lead to more stable homes. Vehicles that are affordable to drive also offer access to a wider choice of goods at more competitive retail prices than the urban core currently offers, and help insulate owners from volatile gasoline prices that otherwise present a stark choice between mobility and (say) food. Such social benefits are far more valuable to the nation than the crude-oil savings, which for a nominal million-vehicle-a-year program would be between 0.2 and 0.4 Mbbl/d.[30]

As mentioned, we would strongly recommend that the GAO analyze the complete benefits and costs of this program, including the likely implications for the U.S. Treasury from the low-income mobility effects and any potential impacts on the used-car market, and that it then compares the overall benefits and costs to those of our second mechanism, which we now detail.

Financing new cars for least-marginal used-car buyers

The second mechanism has, in addition to scrappage described above, one major government involvement. While this option entails no large-scale procurement, it does have a financing mechanism different from the first policy option. It would guarantee reimbursement to current new-car auto lenders for defaults on loans made to the marginal next-in-line borrower category, and would only reimburse loan defaults that are incremental to that of the highest-default customer segment absent any reimbursement guarantee. This option would therefore almost exclusively involve existing market mechanisms and financial institutions. As with the first, its outcome is therefore to provide efficient and reliable mobility in the form of efficient new cars that replace scrapped cars from the used car segment, but in contrast to the first, this option provides such mobility to customers whose present credit record marginally disqualifies them from purchasing a new car. Furthermore, by being conditional upon scrappage, retaining the demand-supply balance in the used-car market, this option results in quality-improvements to all used-car buyers rather than just for the lowest-income buyers.

Our second mechanism draws heavily on the program implemented to ensure financing for a roughly equally risky customer segment, students. The Federal Family Education Loan Program Program (FFELP), and to some extent Sallie Mae[31] set a very useful precedent. Our second mechanism could, but would not have to, involve a separate office with sole responsibility for reimbursing the incremental defaults. In its simplest form, it would be essential to clearly define under what circumstances the default guarantee kicks in, so that the risk profile of these loans are fully defined via a qualification mechanism which specifies who qualifies and for how much credit

The following example illustrates how a potential qualification mechanism could work. If a Financial Services Company's (FSC's) historical baseline cut-off FICo score[32] were 660 and if, after seeing the terms offered by the reimbursement guarantee, they were induced to deepen their lending cut-off point to 640, the reimbursement would pay for any defaults within this FICo range that were incremental to the FSCs documented historical default rate at the 660-level. So, if defaults went from 20% at the 660 level to 23% for the 640-to-660 borrowers, the guarantee would reimburse 3 percentage points of those guarantees, or 13% of all defaults for this segments. With this guarantee, the FSC would be able to treat the 640-to-660 borrower-segment on equal footing with the 660-level borrowers that the FSC already lends to.

Careful structuring of the federal reimbursement guarantee can minimize transaction costs and risks. There would be no "designated agent" such as car dealers or car rental companies. Instead, dealers, who have traditionally originated loans on-the-spot mainly for their parent automakers' financing arm or third parties, would compete with newer entrants, such as the financial service companies (FSCs) that aggregate and securitize loans in the general secondary market, and often finance cars (at very low transaction cost) by mailing directly to qualifying buyers a voucher or check spendable at any dealership.[34]

It is worth noting that the expected loan risk is lower than that of the student loans Sallie Mae buys today, so with risk and cost guaranteed via the reimbursement policy, and the lender's net loan-to-value ratio well below one, it should be an attractive business for FSCs.[35] Default rates should be further reduced because 100% financing (no down payment) improves the borrower's strained cashflow, repairs are free under warranty, and the increased ability to get to work reliably reduces the risk of losing one's job if the car breaks down. The lower-income borrower's new ability to build a sound credit history and equity in the new car—a far more valuable asset than the previous clunker—is an added incentive.

In sum, we've suggested an integrated solution to the problems of making low-income personal mobility affordable while speeding the turnover of the light-vehicle stock without hurting low-income used-car buyers. (Box 19 mentions other remedies for regressivity.) Vehicle scrappage must also be carefully designed to target only vehicles that would otherwise actually drive enough miles to make it worthwhile.[36] And to avoid driving up prices for parts for collectors' vintage vehicles, either the public should be allowed to scavenge them before scrappage (with notice to collectors' groups when a noteworthy vehicle is received), or collectable vehicles should be excluded from the program.[37] [38] [39] [40] [41]

4. Technology Procurement

Overview of Technology Procurement

"Technology procurement" is a policy option that is designed to spur adoption of off-the-shelf technologies into the marketplace via minimal government intervention and via incentivizing all market forces, including those that would normally create market obstacles. It has been used often by many governments in the EU[42] as well as by the U.S. government[43]. The details of the process are very important to get right, and are well described elsewhere[44]. In sum, the process aggregates (what are oftentimes fragmented) user group's specifications on desirable product attributes, communicates the specifications to manufacturers in the form of a carefully run contest, and follows up with various supporting measures to ensure that diffusion takes root.

Key conclusions to date are that success depends on the neutrality[45] and vigor with which the procurement is managed[46]. In Sweden alone, some 32 such contests were put into motion between 1990 and 2000[47], covering six major product categories currently used in the residential, commercial, and industrial sectors. For what are now quite clearly understood reasons, different factors drive success or failure in different markets[48]. In Sweden, various combinations of 17 types of market activities have been deployed for various products, and this is now forming a good basis on which to evaluate market support mechanisms. For a complete matrix of which activities have been used for a given product, please refer to the table in Appendix 2 of Suvilehto and Öfverholm (1998).

Overall, the mechanics involve a public body eliciting manufacturers to satisfy a set of screened and vetted product specification criteria. These criteria have been identified as highly desirable by aggregating input from a large number of users. The users are

commonly, but not always, highly fragmented as a group. The criteria lead to a set of product specifications that cover energy efficiency, and may cover capital cost and other desired qualities. A contest is announced and executed in a carefully timed manner. A program is put into motion that aims at market transformation and consists of procurement and projects supporting product adoption by the market. Contrary to conventional wisdom, a well-executed process will tend to reward both the winning manufacturer as well as its competitors, as experience shows that rather than rendering other manufacturers as losing parties, the manufacturers that don't win tend to refine their products further and ultimately to present the winner with severe competition and no guarantee of gaining market share. The procedure does put any first mover into gear.

Experience with procuring light vehicles

A procurement case already tried in Sweden and that is relatively close to light vehicles is that of electric cars. Here five specific market activities were undertaken, consisting of active buyers groups, media, targeted informational materials, exhibitions, and subsidies for the first trial batch. The procurement program for electric cars began in 1994 and the first car was delivered in 1996. While the electric car does not appear to have made a big market impact in Sweden yet, this example is illustrative for what it would take to bring *SOA*-like light vehicles into the U.S. marketplace faster.

An "active buyers group" would mobilize its purchasing power to generate product demand. In this case, the U.S. government could act as one such buyers group; we propose targeted purchase of vehicles that meet specific criteria for energy efficiency. Media coverage, exhibition presence, and targeted information material availability are components of a general marketing plan that cannot be overlooked, particularly in the U.S. market. We have every reason to believe that investors and companies would in fact demand a very thorough marketing plan ahead of commitments, and the USG should, together with the relevant parties involved, consider how it could provide important support in this regard.

As to subsidies for the first trial batch, in the U.S. this would more likely come in the form of a shared financial commitment. This could possibly be in the form of shared plant cost or, more likely, via two other forms of support: (1) loan guarantees to the manufacturers, and (2) a prize for the first threshold number of vehicles sold into the public marketplace that meets a set of specifications regarding lifecycle and/or operating efficiency.

Outline for mechanics of U.S. light vehicle technology procurement

It is not a given that the U.S. government should give loans to all manufactures that sign up for a procurement program. However, because the U.S.-based light-vehicle manufacturers are sufficiently capital-strapped, we recommend that the government should provide such loans in order to see manufacturing changes occur and to promote global competitiveness. To stimulate both assembly and sales, we propose and analyze a combination of qualified loan guarantees to the OEMs on the supply side, and a

"Platinum Carrot" for the first threshold number of qualifying vehicles that are sold into the public marketplace. Both the loans and the sales-figures would have to purposefully and definitively meet a set of specifications regarding light-vehicle lifecycle and operating efficiency.

The loan guarantees would be linked to the outcome of the Golden Carrot only via the efficiency threshold, i.e., not winning a prize in the Golden Carrot competition should not exclude loan-guarantee support if vehicles with the requisite mpg are being sold into the market.

The Golden Carrot contest would consist of two parts. First, there would be a guaranteed minimum level of demand from government for a set of vehicles that fulfill the set specifications—often this is known as government fleet procurement. This procurement would be technology and manufacturer neutral, and would on a yearly basis review marketplace technologies and renew the government vehicle fleet with the best-in-class vehicles applying standard cost of saved energy efficiency-criteria. Second, there would be a cash prize offered to the top three winning manufacturers to sell into the public marketplace, by a threshold year, a threshold number of light vehicles that conform to a set of ex-ante disclosed efficiency-, performance-, and comfort-related specifications.

BIBLIOGRAPHY for PROCUREMENT section (additional to what is in Endnotes)

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Nilsson, Hans (2003), "Experiences with Procurement as an Instrument for Technical Changes on the Market," forthcoming

ENDNOTES

[1] See for example Horowitz, Marvin J. 2001, "Economic Indicators of Market Transformation: Energy Efficient Lighting and EPA's Green Lights," *The Energy Journal*, Vol. 22, No. 4. From his econometric analysis of the "Green Lights" program of the U.S. EPA, Horowitz not only shows that this effort in support of diffusion of fluorescent lighting ballasts was a very effective policy. He also notes "… it is far more cost-effective to attempt to transform a national market through long-term coordinated coast-to-coast efforts that permit market preferences to evolve and mature, than it is to temporarily manipulate local markets through piecemeal programs that are highly variable from place to place and from year to year. In short, persistent efforts to educate producers and consumers and inform them of energy efficiency benefits appear to be more capable of building sustainable sales volumes and market shares than the alternative of financial subsidies." [[This quote already in book note 769]](p. 121, from footnote 29 in IEA 2003, "Creating Markets for Energy Technologies."). Nevertheless, we would recommend using a multi-stage approach, beginning with a pilot program, and as outlined in the main text.

[2] Kallen, Robert S., Howard A. Learner, Robert Michaels, & Michael Truppa (1994), "Components of a model accelerated vehicle retirement program," a report to the Energy Foundation prepared by Environmental Law and Policy Center, June 1.

[3] http://www.gao.gov/

[4] http://www.gsa.gov/Portal/gsa/ep/home.do?tabId=0

[5] Kallen, Robert S, et. al., 1994.

[6] IEA 2001, pp. 87–89. The most ambitious effort, in Italy in 1997, scrapped 1.15 million light vehicles or ~4% of the national fleet in a year. Payment was scaled to engine displacement, and was conditional on buying a new car—conveniently for firms like Fiat—but sales then dropped, predictably, by about the same amount.

[7] A $1,000/0.01 gpm feebate rate (Greene et al. 2004) would probably reduce demand for cars by ~0.5%, reducing light-vehicle replacement rates by ~100,000 cars/y in 2025. But over the medium-to-long term, this reduces the supply of cars to the secondary market, increasing used-car prices by a couple of percent: e.g., a price elasticity of demand of –1.0 implies that scrapping 1 million cars would raise the average used-vehicle price by $198 (2000 $) in 2005, based on the July 2003 average used vehicle price of $9,092.

[8] Raphael & Stoll 2000, Schachter, J.P., L. Jensen, & G.T. Cornwell. 1998. "Migration, Residential Mobility, and Poverty in Rural Pennsylvania", *Rural Development Perspectives* **13**(2):40–45, www.ers.usda.gov/publications/rdp/rdp698/rdp698f.pdf; Stommes, E.S. & D.M. Brown. 2002. "Transportation in Rural America: Issues for the 21st Century", *Rural America* **16**(4):2–10, www.ers.usda.gov/publications/ruralamerica/ra164/ra164b.pdf

[9] For economic efficiency and Pareto optimality (making someone better off but nobody worse off), we propose decoupling the purchase and scrappage transactions. This would indeed permit focusing scrappage on the least efficient vehicles, further increasing oil (and perhaps pollution) savings, but our model doesn't assume this.

[10] Feebates would likely result in a slight decrease in demand for new cars of about 0.5 percentage points (at a feebate rate of $1,000 per 0.01 gpm). This would tend to slow the transition versus having a feebate with no such effect. From a quantity-point of view this effect is relatively small, as it would amount to an annual drop in light vehicle replacement rates of ~100,000 cars per year in 2025. However, the real issue is that over the medium and long terms, this drop lowers the supply of vehicles to the used-car market. This would have a regressive effect since it would tend to raise used car prices, *ceteris paribus*. While regressivity involves a reduction in the number of new cars demanded, the solution would again involve making financing available to the buyer, either the marginal buyer of new cars, or of a fourth or fifth generation used car.

This sets the stage for the overall solution. First, ensure only qualified vehicles are scrapped. Second, for every 10 scrapped cars, make additional financing available for approximately 12 additional buyers of new efficient cars via either of the two financing mechanisms outlined herein. To arrive at the 10:12 ratio, we have assumed that about 1 million additional buyers of new efficient cars will receive financing, that the new-car demand drop due to feebates is 100,000 cars per year, and that the potentially regressive effect of scrappage truncating the supply at the very low end of the spectrum can be stemmed by not scrapping one additional used car for every eleventh new car that is financed. Careful analysis may show that the ratio is lower or higher than this.

The program would have to ensure that no buyer segments of used cars would end up losing on the deal. While it would be important to hold the total number of cars in the stock roughly constant to achieve the program goal of saving fuel, it is critical that the used-car market does not experience a real price increase as a result of the step-change improvement in used-car quality. Following over time the two flows of buyers and cars demonstrates that nominal prices would likely rise slightly, but also that when adjusted for quality gains and a small downward revision to the ratio of scrappage-to-new-cars financed, all used car buyers would in fact be paying less in real terms and therefore be better off. So, while the number of potential buyers and number of used cars in the first instance would appear to remain unchanged, it would be misleading to think the nominal average price of used cars would remain unchanged. When adjusted for quality, the price would drop in real terms. This stems from losing demand from the customer segment with the highest willingness to pay for used cars. However, in nominal terms, the *average buyer* would now be paying more for their used car, so the nominal price would rise. The increase in average nominal used car price stems from what has happened in the used car market: what occurs on the supply-side is a more-rapid-than usual replacement of the lowest value used cars (those scrapped) with a fresh influx of higher-value used cars (those that come from the expanded new-car market). For as long as the program continues to be in balance, this influx leads to a permanent increase in real value of the stock of used cars.

On the demand side, for the financing mechanism involving the lowest-income earners, there are relatively minor upwards ripple-effects that will not involve loss of welfare for anyone. However, there is a cascading effect resulting from the financing mechanism turning ex-ante marginal buyers of first-generation used cars into lower-end marginal buyers of new cars that needs consideration. This mechanism amounts to an initial drop in demand in this segment of the used-car market. While this drop in demand would induce a price-drop in the high-end used car market, the magnitude of the nominal price drop will not bring today's first-generation used cars down in price to the current level of second-generation nominal prices. Rather, the price drop has two immediate effects that work to equilibrate prices to somewhere between prices in these segments. Since dealers' key concern is to move their used cars off their lots, they will indeed drop prices, and as they do, customers that otherwise would have been in an older vehicle cohort will now buy vehicles from this younger cohort. This demand-stimulus will prevent prices in the segment from making a large drop. However, since used car dealers do have less total pricing power on the sell-side, they will also tend to protect their margins by lowering their offer price to households wanting to trade in their older cars into this segment. Both lead to some friction in pricing, leaving average nominal prices of all used cars to rise slightly but also leaving average real prices to drop slightly.

The equilibrium will tend to settle at a point where each customer now purchases a car at a nominal price that is slightly higher than what they otherwise would have paid, but in real terms lower since each customer gets a car of a quality that is now higher by an amount that outweighs the nominal price rise. In

sum, the real price has dropped since each buyer of used cars would now receive more value per dollar spent due to the quality-increase. This increase in value per dollar spent is what more than compensates for the nominal price rise. So all customers in all segments above the lowest-end used-car segment are in fact better off: they pay slightly more in nominal terms and can afford to do so, but are more than compensated for this due to an improvement in quality that outweighs the nominal price rise. In real terms these segments are therefore better off.

What will happen at the very low end of the used-car segment spectrum? The total number of used cars available *in this segment* will drop due to the scrappage component of the program design. The effect will be to truncate the supply of the lowest-end used cars. This truncation will force those with the lowest purchasing power in the market for individual vehicle mobility to consider used cars that, while of better quality than previously, no doubt will be slightly more expensive in nominal terms. There is an unavoidable nominal price increase also in this segment.

This calls for a slight downward adjustment of the ratio of scrapped cars to financing of efficient new cars. Such an adjustment will safeguard against the inevitable possibility of altogether excluding the very last buyers in the used-car market—indeed a highly undesirable regressive consequence. The exact adjustment should probably be determined by a careful GAO analysis of used-car market pricing under the policy scenario here outlined. Until this detailed analysis is done, we indicatively decrease the ratio from 10:11 to 10:12 to account for the adjustment.

[11] DOE 2001. *Transportation Statistics Annual Report 2001*. Washington DC: Bureau of Transportation Statistics. Fig. 1. www.bts.gov/publications/transportation_statistics_annual_report/2001/html/chapter_04_figure_01_083.html Fig. 2 shows 18% of 1999 households were without cars in the central city but only 4% in rural areas.

[12] Kallen, Robert S, et. al., 1994.

[13] Kallen, Robert S, et. al., 1994.

[14] It is not a given that low-income people drive more inefficient cars, although on average, they do drive marginally less efficient cars. Khazzoom 1999 [[[NG please make sure this is the right Khazzom ref!]](pl. [what is pl.?]]12) notes that 1993 households with average incomes ≤$15k vs >$50k had average vehicle efficiency of 19.8 vs. 20.1 mpg. No newer data are available. Driving was 49% lower in the lower-income households (14,109 vs. 27,740 miles).

[15] Andrew, E.L. 2004: "The Ever More Graspable, and Risky, American Dream." *N.Y. Times*, 24 June.

[16] Ball, J. 2004. "For Many Low-Income Workers, High Gasoline Prices Take a Toll." *Wall St. J.*, p. A1, 12 July.

[17] Tan, Lucilla, "Spending Patterns of Public Assisted Families," Monthly Labor Review, May 2000, pp 29–35, www.bls.gov/opub/mlr/2000/05/contents.htm. In contrast, the average household's $57,835 income was split 32%, 20%, 13%, 6%, and 5%, respectively.

[18] Ball 2004.

[19] IEA 2003, "Creating Markets for Energy Technologies." Available online at http://www.iea.org/dbtw-wpd/bookshop/add.aspx?id=57

[20] A recent study by major car and oil companies found from roadside real-time emission measurements in Denver that even as newer, cleaner vehicles emitted less of the smog-forming pollutants, the fraction emitted by the dirtiest tenth of the vehicles held steady or rose: by 2003 it accounted for 69% of the fleet's CO, 75% of HC, and 54% of NO_x. WBCSD 2004, p. 100. Similar issues are far more acute in most giant cities in developing countries, where similar remedies would be worth considering—not just for cars but also for e.g. the dramatically pollution-reducing two-stroke scooter retrofits developed at Colorado State University.

[21] Now that U.S. new-vehicle efficiency has been nearly flat for two decades, the opportunity to save a great deal of fuel by scrapping the oldest vehicles is largely gone; but the least efficient vehicles are also often the heaviest, most aggressive, and least compatible with their lighter roadmates. Where this is true, scrapping them would improve public safety (and slightly increase recovery of currently scarce scrap steel).

[22] This doesn't mean that *all* scrappage is worthwhile. We tested *Kelley Blue Book* prices and EPA efficiency data to check the "scrappage resource" supply curves for some popular models, relating their age to the $/bbl cost of saving oil by scrapping them. Most of the inherently inefficient heavy models are relatively new and valuable, making their CSE relatively high. Scrapping older cars is often a more cost-effective oil-saver, but the amount saved is smaller.

[23] This alignment of provider with customer interests illustrates the "solutions economy" business model described by Hawken, Lovins, & Lovins 1999, Ch. 7, and in the forthcoming book *The Solutions Economy* by J.P. Womack & D.T. Jones.

[24] Most lease programs require comprehensive and collision insurance in order to provide coverage in the event of physical damage to the automobile. We assumed that low-income owners of older, used cars do not typically carry this type of insurance coverage, and added $583/y as an incremental cost (GEICO quote for a 2004 Toyota *Prius*). This is generous because a lessor would bulk-buy the insurance. We do not assume a price premium for insurance coverage (e.g. theft) because electronics-rich modern hybrids like the keyless *Prius* are very difficult to steal, relatively hard to resell illegitimately, and easy to equip with GSM transponder and remote-shutoff systems. Third-party collision liability insurance would be bought at the pump, as explained in the implementation section of the main report. [[this footnote repeating text from the chapter above]]

[25] The average bottom-quintile-income family spent $1,048 on used car purchases in 2002 Bureau of Labor Statistics, http://data.bls.gov/labjava/outside.jsp?survey=cx.

[27] From Bureau of Labor Statistics, http://data.bls.gov/labjava/outside.jsp?survey=cx. Obtained by choosing categories 'Vehicle Purchases, Cars Trucks, Used', 'Quintiles of Income before taxes', and 'Lowest 20 percent income quintile', for 2002, giving $1,048, see http://data.bls.gov/servlet/SurveyOutputServlet?jrunsessionid=1091684646634223661

[28] www.Edmunds.com and *Kelley Blue Book.*

[29] Raphael, S. & M. Stoll. 2000, "Can Boosting Minority Car-Ownership Rates Narrow Inter-Racial Employment Gaps?." *Brookings-Wharton Papers on Urban Economic Affairs* **2**: 99–145. Washington, DC: The Brookings Institute. http://urbanpolicy.berkeley.edu/pdf/RS2001PB.pdf.[[This statement does not imply that only black and Latino families make up the lowest income quintile. However, black families accounted for 16 percent of lowest 20% income quintile in 2002 ("White and Other" accounted for the remaining 84%), and decreasing percentages of the higher income quintiles—14%, 11%, 9%, and 6% (from the Bureau of Labor Statistics, http://data.bls.gov/labjava/outside.jsp?survey=cx).[[all this is repeated elsewhere]]

[30] Assuming gasoline savings from driving a constant 12,950 miles per year for the annual replacement of 1 million 23-mpg 1985 Compact cars with 37.5-mpg and 90-mpg (all adjusted mpg) *CW* and *SOA* cars over 14-y average lifetime, saving between 0.2 and 0. 4 Mbbl/d.

[31] The Student Loan Marketing Association (SLMA or "Sallie Mae") was established by Act of Congress in 1972 as a Government-Sponsored Enterprise; floated on the NYSE in 1984; privatized in 1997; and ultimately renamed in 2002 (www.salliemae.com/about/slma_name.html). The history is relevant. When the Education Act was passed in 1965, FFELP was set up to cover any defaults on student loans issued by the banks, but by the early 1970's, this repayment provision for delinquent loans proved too slow and inadequate, and the banks stopped lending—because the lag between declaration of default and government repayment destroyed the lenders' liquidity. Creating Sallie Mae fixed this problem by buying the student loans very shortly after issuance. This increased both liquidity and loan volume: relieved of default risk, each bank could fully satisfy loan demand from the next student cohort.

[32] Fair Isaac's Company, Inc., a company that aggregates credit-related information on individuals into a consumer-lending-risk rating system, analogous to what Moody's and S&P have for corporate and sovereign debt. A perfect consumer credit ('FICo') score is 800. It is common knowledge in the auto lending industry that a score below ~660 usually disqualifies a consumer from obtaining a new-car loan.

[33] As a declared aggregator, the government reimbursement guarantee could expect issuing sub-prime auto lenders to offer a small portfolio of higher-risk loans on efficient new cars. The government's access to loan-specific information from all offering lenders would permit assessment of the various risk profiles. Efficient lender/reimburser communication should clear the price and risk markets. Although the retail lenders would have to lower their acceptable FICo-threshold to deepen their sub-prime lending, the risk-profile of the marginal borrower for the efficient *new* car wouldn't be particularly severe—just the current lowest-risk high-end buyer of used cars. Retail lenders, to qualify for repurchase, would need to demonstrate that their loans are incremental and marginal vs. their track record in the overall new-car market (not just that for efficient new cars).

[34] FSCs do this today for relatively safe customers (those with FICo-scores above ~650), and mail them such vouchers just as they mail out credit-card offers. There is no conceptual difference except that the new-car voucher has far better collateral.

[35] Sallie Mae loan clients (students) have ~20–40% default rates; sub-prime auto borrowers, an estimated ~20–35%. Although default rates are proprietary, one deep sub-prime auto lender (Texas-based Drivetime, www.drivetime.com/) reportedly charges well over 20%/y for its lowest-rated used-car buyers, who probably score well below 550. This implies expected default rates around 25–40%, so for the riskiest new-car buyers, ~20–35% seems reasonable. However, unlike an uncollateralized loan, the FSC's loan is secured by the new car, which is easily traced, can be repossessed, and can even be equipped with an anti-default locking device.

[36] E.g., by strictly enforced requirements such as valid registration for at least one year prior to scrapping and demonstrating roadworthiness by driving vehicles to the dealership, then ensuring that vehicles turned in are scrapped so that they do not reappear. Empirical evidence (Kallen 1994, Dill 2004) suggests that scrappage incentives tend to attract lower-income households that drive their clunkers more, rather than higher-income households seeking to dispose of a surplus vehicle. However, low-income households with the highest driving levels are unlikely to be attracted by a $500 scrappage bonus because that's not enough to buy a replacement clunker. About three-fourths of vehicles scrapped in Bay Area programs would otherwise have been driven, as program designers assumed, for about three more years. J. Dill 2004. "Scrapping Old Cars." *Access* **24**:22–27. Spring. www.uctc.net/access/access.asp Some programs

specifically target the most polluting cars, or those that have just failed smog tests. Some, like British Columbia's Scrap-It, offer a variety of compensation options including a free transit pass (which most participants chose: www.cleanairnet.org/caiasia/1412/article-37169.html).

[37] UniDev LLC (), for good-sized projects, recently cut the income required for a $338,000 home from $106,000 to $43,000 and for a 1,000-ft^2 two-bedroom apartment from $81,000 to $39,000.

[38] WBCSD 2004, pp. 139–141. The European and U.S. car-sharing news sites are respectively www.carsharing.org and www.carsharing.net; the World CarShare Consortium is at http://ecoplan.org/carshare/cs_index.htm. U.S. car-sharing typically saves money if you drive less than ~7,500 mi/y, and is available in more than three dozen cities.

[39] See www.flexcar.com/vision/impact.asp.

[40] This service, www.mobility.ch, is now available to ~60% of the population of Switzerland. It combines in a single fee a free or discounted pass for public transportation and a short-term service to drive the vehicle of your choice (in some cities, dropped off to and picked up from your location by a bicycle courier). It could be extended to include e.g., a cashless backup taxi service, a travel agency, and a broadband Internet service provider (for videoconferencing and, soon, virtual presence). Such business models work because not everyone needs a car at once; the average U.S. private car has an asset utilization of only 4%, so it stands idle 96% of the time.

[41] A possibly apocryphal, but financially plausible, story relates that several hundred residents of a distressed Massachusetts town sold their cars, pooled the proceeds into a nonprofit group, and bulk-bought a fleet of identical, efficient Honda cars—enough to get the dealer price, and thanks to the nonprofit ownership, tax-free. Every two years, they sold the fleet and bought a new one, thus staying in warranty and remaining a qualified dealer. They also bulk-bought insurance, fuel, and a two-person maintenance staff (formerly employed seasonally to keep up the town's snowplows). Car-sharing—cars were booked and checked out like a library book—further reduced costs because not everyone needs a car at once (the average U.S. private car stands idle 96% of the time). The alleged net annual savings totaled about $5,000 per household—a huge boost, equivalent to one-fourth of total income for the bottom quintile of American households.

[42] Olerup, 2001; Wene and Nilsson, 2003; Suvilehto and Öfverholm, 1998; IEA, 2003.

[43] Hollomon et. al., 2002; Wene and Nilsson, 2003. For example, in the 1990s, DOE led procurements of high-efficiency clothes washers, sub-compact fluorescent lamps, recessed downlight fluorescent fixtures and commercial packaged air conditioners.

[44] Olerup, 2001; Wene and Nilsson, 2003; Suvilehto and Öfverholm, 1998

[45] Nilsson, 2003, concludes: "Above all, the procurement must be strictly neutral. There must not be any preferences for companies, their origin, or their design of the product." And: "… [this is] nevertheless often forgotten by policy makers who would like to see their home country manufacturers to take the lead."

[46] Suvilehto and Öfverholm, 1998

[47] Olerup, 2001.

[48] For example, Olerup (2001) finds that the major reasons for the tremendous success of the NUTEK commercial lighting program had to do with the coherency of the approach: Several separate but coordinated initiatives were put in motion, succeeding in determining an appropriate set of multiple

requirements not just focusing on energy efficiency per se but for example also on quality aspects, such as the lighting being flicker-free in addition to energy-efficient. Similarly, since the commercial ventilation program only consisted of one power class and since there were not as many supporting market activities, this program did not see a significant diffusion achieved. For residential brine-water heat pumps, success has been traced back to a highly committed procurement winner and heat pump trade association, an active and committed NUTEK involvement, as well as a customer hot-line. See also Hollomon et. al. 2002 for evaluation details on the U.S. procurement experiences in the 1990s.

Table 22-1: THE $0.15/DAY INCREMENTAL COST, 5-YEAR LEASE OF NEW *SOA* COMPACT CAR

NET UP-FRONT FUNDING NEED			
SOA Mfg Cost	$	11,198	Per car
Taxes	$	-	Government owned vehicles
OEM markup	$	1,120	
Dealer markup	$	1,064	
Destination Charge	$	500	Average cost to dealer
Net up-front funding need	$	13,882	
Feebate $2,000/0.01gpm		($4,026)	Pivot @ ~32 mpg ~2015
CO2 (PV)		($116)	PV for 5 years (GSA removing barrier)
NO*x* (PV)		($463)	PV for 5 years (GSA removing barrier)
Net Cost to Car co.	$	9,277	
NET COST TO CUSTOMER			
Depreciation over 5 years		53%	From Kelley Blue Book and Edmunds
Value depreciated over 5 years	$	4,871	Value of car used during lease period
Cash Value of scrapped car		($1,500)	Payment from govt thru CarCo
Insurance over 5 years, retail	$	2,914	Per GEICO ests, excl whsl disc & PATP (Pay-at-the-Pump)
Insurance over 5 years, markup		30%	RMI best estimate
Insurance over 5 years	$	2,040	Per GEICO ests, with whsl disc, w/o PATP
Req'd Maintenance Program	$	1,177	Toyota mntce Program – 5 yrs
State Fees (Title and Registration)		412	From Kelley Blue Book
Net Value to be Financed	$	7,000	
GROSS MONTHLY FINANCING NEED			
Treasury Rate		4.76%	10-y, 8 June 2004
Markup		50	bpts
Cost of loan		5.26%	p.a.
		0.438%	Per month
Term		5	yrs
		60	months
Monthly cost with financing		($132.93)	Per month
25% Default Coverage		($44.05)	Per month, industry ests
TOTAL MONTHLY PAYMENT		($176.97)	Per month
NET INCREMENTAL MONTHLY FINANCING NEED FROM CUSTOMER			
		23.00	mpg of scrapped 1985 compact (adj)
		89.93	mpg of SOA car (adjusted)
		12,950	Miles per year
		419	Gallons p.a.
		$1.50	Gas at nozzle
		$0.45	PATP
		$1.95	Gas at nozzle w/ PATP
Fuel Saving		$817.14	Saved per year
Fuel savings		$68.09	Saved per month
Avoided used car purchases		$87.33	Per month
Eliminated maintenance		$26.50	Per month
Repairs not covered by warranty		($9.36)	Avg per Kelley Blue Book and Edmunds
Total new sources of funds		$172.57	Per month
NET INCREMENTAL COST OF LEASE		($4.40)	Per month paid by low-income user

Table 22-2: THE $2.30/DAY INCREMENTAL COST, 5-YEAR LEASE OF NEW *CW* COMPACT CAR

NET UP-FRONT FUNDING NEED			
CW Mfg Cost	$	10,009	Per car
Taxes	$	-	Government owned vehicles
OEM markup	$	1,001	
Dealer markup	$	951	
Destination Charge	$	500	Average cost to dealer
Net up-front funding need	$	12,461	
Feebate $1,000/0.01gpm		($669)	Pivot @ ~30 mpg ~2015
CO2 (PV)		($60)	PV for 5 years (GSA removing barrier)
NOx (PV)		($241)	PV for 5 years (GSA removing barrier)
Net Cost to CarCo	$	11,492	
NET COST TO CUSTOMER			
Depreciation over 5 years		53%	From Kelley Blue Book and Edmunds
Value depreciated over 5 years	$	6,033	Value of car used during lease period
Cash Value of scrapped car		($1,500)	Payment from govt thru Car co.
Insurance over 5 years, retail	$	2,914	Per GEICO est's, excl whsl disc & PATP (Pay-at-the-Pump)
Insurance over 5 years, markup		30%	RMI best estimate
Insurance over 5 years, wholesale	$	2,040	Per GEICO ests, with whsl disc, w/o PATP
Req'd Maintenance Program	$	1,177	Toyota Mntnce Program – 5 yrs
State Fees (Title and Registration)		412	From Kelley Blue Book
Net Value to be Financed	$	8,162	
GROSS MONTHLY FINANCING NEED			
Treasury Rate		4.76%	10-y, 8 June 2004
Markup		50	bpts
Cost of loan		5.26%	Per year
		0.438%	Per month
Term		5	Years
		60	Months
Monthly cost with financing		($155.01)	Per month
25% Default Coverage		($54.56)	Per month, industry ests
TOTAL MONTHLY PAYMENT		($209.56)	Per month
NET INCREMENTAL MONTHLY FINANCING NEED FROM CUSTOMER			
		23.00	mpg of scrapped 1985 Compact (adj)
		37.53	mpg of CW car (adjusted)
		12,950	Miles per year
		218	Gallons per year
		$1.50	Gas at nozzle
		$0.45	PATP
		$1.95	Gas at nozzle w/ PATP
Fuel Saving		$425.07	Saved per year
Fuel savings		$35.42	Saved per month
Avoided used car purchases		$87.33	Per month
Eliminated maintenance		$26.50	Per month
Repairs not covered by warranty		($9.36)	Avg per Kelley Blue Book and Edmunds
Total new sources of funds		$139.90	Per month
NET INCREMENTAL COST OF LEASE		($69.67)	Per month paid by low-income user