

Background Paper

Why Subsidizing Alternative Fuels is Not Sensible

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Executive Summary

Recently federal and state governments have implemented programs that encourage the purchase of alternative fuel vehicles and promote alternative fuel use. The cost of alternative fuel subsidies is substantial. In a recent API report, Anderson [1994] estimated that current federal subsidies cost more than one billion dollars annually. Similarly, Sierra Research [1995] estimated that total federal and state subsidies in California are expected to be \$2.7 billion over the next six years (1995 to 2000). Substantial alternative fuel programs exist in other states as well.

This background paper debates the legitimacy of government policies that support the commercialization of alternative fuel vehicles. The paper examines the emission reduction and energy security benefits of alternative fuel vehicle use, which, purportedly, are not captured in the marketplace. The paper also critiques the rationale that government alternative fuel programs create jobs or advance the international competitiveness of the U.S. The main conclusion of the paper is that the case for alternative fuel subsidies is weak. The environmental or energy security advantages of alternative fuel vehicles are modest, at best. Moreover, other government programs are more cost-effective at reducing vehicle emissions and minimizing the macroeconomic impacts of crude oil supply disruptions. Finally, subsidies are a poor choice as an instrument of government policy. Subsidies distort relative price signals, hiding the true cost of alternative fuels and possibly favoring the wrong vehicle technology. In contrast, providing a level playing field for all fuels has many advantages. With fuel neutral environmental performance standards, the market guides producers to the most cost-effective technology. Using this approach, government support for alternative fuels is unnecessary, avoiding the inefficiencies of subsidy programs.

I. Background and Summary

Recently, both federal and state governments have implemented programs to encourage the purchase of alternative fuel vehicles and to promote use of alternative fuels. The most important statute is the Energy Policy Act of 1992, which provides subsidies and tax advantages for alternative fuel vehicles and fueling stations and requires public and private fleet operators to purchase millions of these vehicles. At the state level are other subsidies, such as rebates to buyers of alternative fuel vehicles, increased utility rates to develop fueling infrastructure or to sell fuel below cost, and alternative fuel vehicle purchase requirements, like the mandated sale of zero emission vehicles (electric cars) in California, New York and Massachusetts. In the Northeast, state regulators want the auto manufacturers to market Advanced Technology Vehicles, which could use alternative fuels, as part of a compromise to substitute the vehicle manufacturer's proposed 49-state vehicle program for the Ozone Transport Commission's low emission vehicle program. The cost of alternative fuel subsidies is substantial, both at the federal and state levels. In a recent API report, Anderson [1994] estimated that current federal subsidies amount to more than one billion dollars annually. Similarly, Sierra Research [1995] estimated that total federal and state subsidies in California are expected to be \$2.7 billion over the next six years (1995 to 2000). Substantial alternative fuel programs exist in other states as well, as documented in the Energy Information Administration's [1994] report on alternative fuels.

In many cases, the costs of the alternative fuel vehicles and alternative fuels are higher than the cost of conventional vehicles and conventional or reformulated gasoline. Further, alternative fuel vehicles often exact driving performance, range, or trunk space penalties, relative to gasoline vehicles. The higher costs over a vehicle's life and lower performance of many alternative fuel vehicles make them relatively

unattractive in the market. Thus, it is not surprising that some businesses required by the Energy Policy Act to use alternative fuel vehicles – along with alternative fuel advocates – support subsidies to ease the economic burden. Supporters of subsidies often argue that they are justified because the full benefits of alternative fuel use, including reduced emissions and improved energy security, are not captured by users. Unfortunately, little attention has been given to the extent to which either environmental or energy security costs have been internalized by existing taxes and government programs that reduce emissions or improve energy security. Overall, the case for alternative fuel subsidies is highly questionable. Subsidies are inefficient, at times unfair, and likely to provide misguided signals about what technology will work best in the future.

Subsidies can take many forms, but four are prominent in the current debate. One is subsidization of alternative fuel vehicle development. While encouraging innovation is a legitimate role of government, subsidizing efforts to commercialize technologies is not. Unfortunately, the government is involved both in research and in programs to commercialize alternative fuel vehicle technologies. The temptation on the part of government to support a single “winner” often is irresistible and has led to “white elephant” investments of taxpayer funds. A second form of subsidization is utility ratepayer funding of expenses related to promotion of alternative fuels and development of alternative fuel vehicles and associated fueling infrastructure. It is inappropriate for ratepayers to cover the cost of commercializing alternative fuels when the increased use results primarily from government fleet alternative fuel vehicle requirements. Third, technology forcing environmental standards can be set which, in effect, mandate alternative fuel vehicle sales. These can impose large costs relative to societal benefits. Standards should be set on the basis of environmental benefits and costs, not to achieve a technological objective. The market should determine which technologies are economically viable. Fourth, alternative fuels can be subsidized by

reducing fuel excise taxes that are earmarked for highway construction and maintenance. Obviously, the loss in revenue must be made up by other taxes or cuts in highway spending.

This paper provides an overview of the debate on the legitimate role of government in supporting the commercialization of alternative fuel vehicles. It first examines the emission reduction and energy security benefits of alternative fuel vehicle use, which, purportedly, are not captured in the marketplace. Assuming government involvement is justified by such benefits (which this paper argues is a dubious proposition), the discussion shifts to how government best remedies the perceived problems. The paper also critiques the rationale that government alternative fuel programs create jobs or enhance technological progress in the U.S. The main conclusion is that the case for alternative fuel subsidies is weak. The environmental or energy security advantages of alternative fuel vehicles, relative to conventional vehicles, are modest, at best. Moreover, many existing government programs are focused on reducing vehicle emissions and minimizing the macroeconomic impacts of crude oil supply disruptions. Finally, subsidies are a poor choice as an instrument of government policy. Subsidies distort relative price signals, hiding the true cost of alternative fuels and possibly favoring the wrong vehicle technology. In contrast, providing a level playing field for all fuels has many advantages. Environmental goals are efficiently realized by setting technologically neutral standards. Over time, the market guides producers to provide the most cost-effective technology to meet environmental requirements. Under this approach, government support for alternative fuels is unnecessary, avoiding the inefficiencies of subsidy programs.

II. The Legitimate Role of Government : Externalities and Alternative Fuels

Alternative fuel proponents claim that government intervention in energy markets is justified since the price of petroleum products does not capture the environmental or

energy security costs associated with petroleum product use.¹ In their view, alternative fuels deserve government support because they can replace petroleum which is overused given its too low social price. This line of reasoning is unconvincing for two reasons. One, the difference between the market and social cost of petroleum product use is exaggerated. Two, even if there are environmental and energy security benefits of alternative fuel use, subsidies are a poor instrument to remedy the problem and may even make the outcome worse by backing a less promising technology.

A. Petroleum Imports and Energy Security

Energy security and its relationship to alternative fuels is often misunderstood. Sometimes, the energy security concern is associated, mistakenly, with the volume of crude oil imports. This focus on the level of imports is misplaced. The energy security problem is not due to any long-term physical shortage of crude oil, nor is it concerned with the fact that the U.S. imports petroleum. Worldwide petroleum reserves are enormous and are growing, though they are mostly located outside the U.S. Historically, shortages have occurred only when price controls were present; these controls were fully removed in the U.S. in the early 1980s. Imports *per se* are not a problem, but simply reflect the fact that the cost of finding and producing crude oil is lower elsewhere. Clearly, U.S. citizens would not be better off paying more for crude oil when it is available at lower cost elsewhere.

Energy security costs arise from three possible circumstances, each associated with the price of crude oil or rapid changes in that price. First, consumers worldwide

¹ Conceptually, other externalities (that is, costs not included in the market price) such as road noise, underpriced vehicle parking, and congestion, might be legitimately included in the social cost of vehicle transportation. However, these costs are not changed by substituting alternative fuel vehicles for conventional gasoline vehicles, and for this reason are not discussed in this paper. Other justifications, such as job creation benefits resulting from new alternative fuel vehicle production are also asserted by alternative fuel proponents. These less compelling arguments are discussed later in this paper.

could pay a higher than competitive price for petroleum products, if crude oil's supply were controlled successfully by a cartel. Second, given political instability in the Middle East, a military presence may be necessary to protect petroleum assets and transportation routes. If correct, this could increase the real cost of oil imports. Finally, the economy bears adjustment costs when crude oil prices increase rapidly due to supply interruptions associated with political instability in petroleum producing areas.

Though the worldwide oil market has changed substantially in the last twenty years, many people still believe that the Organization of Petroleum Exporting Countries (OPEC) sets the price of oil, extracting monopoly profits from consumers. It has been suggested (see, for example, Broadman and Hogan, 1988) that the U.S. or any other large buyer could offset the monopoly power of OPEC by setting a tariff on oil imports. This is alleged to have two beneficial effects. One, the world price of oil would decline as U.S. consumption was reduced by the tariff. Two, the U.S. government would, in effect, collect some portion of the monopoly profits that otherwise would accrue to OPEC producers. If this hypothesis were correct, implementing such a policy would reap an energy security benefit. However, both the underlying premise and the recommended policy are questionable.

Most observers agree that OPEC's market power is much diminished. Some economists even argue that in the 1970s OPEC's monopoly power was exaggerated and that the price runups then were the consequence of: (1) political events that triggered consumers, companies and countries to rapidly increase crude oil and petroleum product inventories; and (2) the presence of U.S. price and allocation controls. Even if one assumes OPEC has some ability to control the price of oil, it may not be in its member's interest to exercise the full extent of its pricing power. While the large OPEC nations once had simple export based economies, that situation has changed significantly. Today, foreign crude oil exporting countries experience as much

market risk as consumers. Some OPEC members now have substantial investments in western economies, and those investments would be hurt by energy price increases.

It is important to recognize that if OPEC has underutilized market power, it could use this power and retaliate against consuming countries who attempt to lower international prices through domestic policies designed to reduce petroleum use. Perhaps the most important consideration on the use of importing countries' market power to reduce petroleum's price is to consider why petroleum is so special. Why not use a nation's buying power to extract better prices on other products that are bought and sold in international markets? World leaders now realize that such behavior is counterproductive, ultimately reducing the welfare of all parties. There would have to be compelling reasons to make an exception for oil.

Finally, any discussion of OPEC pricing power must address regional politics. Historically, it is not credible to maintain that the large Middle East producers can coordinate long-term crude oil prices. OPEC is not powerless, but under most foreseeable conditions, the risk of sustainable higher oil prices is fairly low.² The greatest risk now continues to be the possibility of price spikes from occasional supply disruptions.

Sometimes proponents of alternative fuels argue that the real energy security issue is the need for the U.S. to maintain a significant military presence in the Middle East to protect Persian Gulf oil. In an extreme variation of this argument, the full cost of the military operation in Kuwait in 1990 is divided by imports from the Middle East as an estimate of the energy security cost of importing oil. This is clearly misleading, since there are non-oil related reasons for a military presence (for example, as an ally of

² There is some risk of extortion of weaker countries by a militarily dominant member of OPEC to increase oil prices, assuming such an increase was in the interest of the dominant country. This risk may partly explain the military presence of some consuming countries in the Middle East.

Israel) and since contributions by Kuwait and Saudi Arabia and other allies covered most of the military campaign's cost. Further, this measurement of the energy security cost is counterintuitive, since the less oil imported from Middle East countries, the higher the premium assigned per barrel to protect it. Currently, only 11 percent of petroleum consumed in the U.S. comes from the Middle East. Even a less extreme variation on the military oil security premium hypothesis is questionable, however. One has to be able to argue that our military commitment would be less if our import dependence were less to justify this variation of the energy security premise. If alternative fuel substitution reduced U.S. imports from the Middle East by half, amounting to a change of less than one million barrels per day, would our military commitment change? As Bohi [1995] argues, the willingness to intervene militarily in the Middle East involves protecting an important component of world oil supplies, which for all practical purposes is independent of changes in U.S. import levels. One could even argue that the entire worldwide oil production and distribution system requires protection (to counter regional insurgency and terrorist activity) and the U.S. has a legitimate military role in such protection, even if we import no oil. Thus, any import energy security premium tied to defense expenditures is difficult to isolate or measure, and probably is an illusion.

However, prices can increase rapidly when consumers and producers perceive reductions in supply, as occurred after Iraq's invasion of Kuwait. But, a short-term disruption of supply can be countered effectively by selling oil from the strategic petroleum reserves of the U.S. and other nations. As argued earlier, the fraction of oil imported has little economic significance in a disruption. The price the U.S. pays for oil is the international price, irrespective of how much is imported. Thus, the disruption cost due to a supply interruption, for all practical purposes, is independent of the percent of oil imported, and proportional to the magnitude of the price increase in a disruption event. This fact frequently is not understood.

Alternative fuels might possess some energy security value, but that value comes from diversifying energy sources, not from reducing petroleum imports. Diversifying sources might increase energy security by reducing the price runup and associated macroeconomic costs associated with a disruption of petroleum supply in the Middle East. A petroleum price runup is mitigated by lower demand for petroleum, particularly if alternative fuel vehicles are designed to operate on gasoline or alternative fuels, allowing fuel switching when oil disruptions occur. Reducing imports is desirable, but only if in doing so, energy sources are diversified or total energy expenditures are reduced.

The energy security implications of substituting alternative fuels for petroleum fuels vary by fuel. As the preceding discussion indicates, each alternative fuel should be judged on whether its use in place of petroleum leads to a reduction of disruption costs, by reducing the expected size of price runups during disruption episodes. At the outset, it is important to keep in mind that the macro-scale impact of projected substitution of alternative fuels resulting from the mandates in the Energy Policy Act is modest, so that any beneficial price reductions are likely to be too small to be perceptible.

Substitution of liquid petroleum gases (LPG), mostly propane, or compressed natural gas (CNG) for gasoline would reduce crude oil imports, but would not improve energy security. For both LPG and CNG, decreased oil imports would be offset in part by increases in other energy imports. Since the current U.S. supply of LPG is small relative to other energy products, increased use of LPG as a vehicle fuel can only occur by competing with current users in the chemical industry and in the agricultural sector or by importing it, mostly from the same countries from whom we currently import

petroleum. Because the amount of domestic LPG available for vehicle use is relatively small, any improvement in energy security would be imperceptible.

In contrast, the supply of the natural gas needed to make CNG could be increased modestly by increasing production or by increasing Canadian imports. Of course, some current users of natural gas could be backed out of the market by higher natural gas prices associated with new competition for natural gas use in the transportation sector. Further, many believe that there are substantial domestic (or Canadian) gas resources yet to be developed, if the price of natural gas increased sufficiently to develop these resources. So initially, CNG could replace some oil imports. This could improve energy security slightly, since the gas feedstock could be domestic (or Canadian) and not subject to the disruption price risk of the petroleum it replaces. If large-scale substitution of CNG for gasoline were to occur, however, the price of natural gas in the United States would go up, and we would have to import liquefied natural gas (LNG) from other countries, where natural gas could be produced for less. A substantial amount of this gas likely would come from the Middle East. In that case we would be exchanging oil dependence for natural gas dependence. Because imports of non-petroleum products would increase while petroleum product imports decrease given higher vehicular use of LPG and CNG, some improvement in energy security, though small, would occur. The diversification of transportation fuels, particularly if dual fuel vehicles provide fuel substitution flexibility, tends to reduce the size of a petroleum price runup and thereby reduces the macroeconomic effects of a disruption.

Substituting methanol for gasoline also could reduce crude oil imports, but again would not improve energy security. The reduction in crude oil imports would be offset by an increase in methanol imports. Methanol can be made from many things (including coal) but right now the least-cost feedstock is natural gas, and that gas is plentiful

and inexpensive in the Middle East. Though fuel supplies would be diversified to a degree, methanol imported from the Middle East is just as vulnerable to supply disruptions as the crude oil. The recent rapid runup in methanol's price in a tight world market in 1994 demonstrates that methanol's price volatility offers little if any advantage relative to petroleum.

Electricity as a substitute for petroleum-based fuels could provide an energy security benefit, since the additional electricity likely would be produced by domestic energy sources – either coal (mostly) or natural gas. The price of electricity is stable and relatively independent from world petroleum markets, so that use of electric powered vehicles would provide some energy security benefit. Of course, unless substantial substitution were economically attractive, this benefit would be minuscule. Large-scale substitution of electric for gasoline vehicles seems unlikely without significant technical progress on batteries to reduce today's performance disadvantages of electric vehicles.

In sum, though there is some potential to improve energy security by substituting a domestic non-petroleum fuel for imported petroleum-based fuels, the improvement would be modest, at best. State or regional efforts designed to encourage greater regional use of alternative fuels would have no measurable effect on the price of oil. Bohi [1995] and Montgomery and Sweeney [1991] indicate that the energy security cost of petroleum product use is small and policies designed to remedy such perceived problems are likely to cause more harm than good.

B. Alternative Fuel Vehicle Emissions

Vehicle emission performance is the second area where alternative fuel proponents argue that market outcomes are not socially efficient. While in some cases

there is an emissions reduction benefit in substituting alternative fuel vehicles for conventional gasoline vehicles, the emissions reduction is small and offers little justification for government intervention. There are two reasons the difference in emissions between gasoline and alternative fuel vehicles is not significant. First, because of rapid change in vehicle emissions control technologies, which are available to both gasoline and alternative fuel vehicles, the baseline level of emissions is small (vehicle emissions control systems have eliminated 95 to 99 percent of uncontrolled emissions). Second, even though some alternative fuel vehicles are intrinsically cleaner, for example dedicated LPG and CNG vehicles which do not have evaporative emissions, emissions performance standards tend to equalize the actual emissions of conventional and alternative fuel vehicles. Thus, the lower emissions advantage of some alternative fuel vehicles may not be realized, though the emission control cost for these vehicles may be lower. A brief overview of the emissions advantages and disadvantages of the alternative fuel choices (including reformulated gasoline) is worthwhile.³

Most of the alternative fuels (and reformulated gasoline) have lower volatile organic compound (VOC) emissions relative to conventional gasoline. VOCs and nitrogen oxides (NO_x) are the emission precursors of ozone, the major constituent of smog. CNG and LPG vehicles provide a substantial reduction of VOCs (40 to 60 percent, according to the National Petroleum Council, 1993) in part by eliminating evaporative emissions. The impact on NO_x is mixed and subject to some controversy, with some tests showing slightly higher NO_x emissions for LPG and CNG. Given the reduction in VOCs and the lower reactivity of the VOCs, Chang *et al* [1991] conclude that use of CNG would reduce ozone formation by about 60 percent relative to conventional gasoline and LPG would reduce ozone formation about 35 percent. (In

³ The emissions performance of alternative fuel vehicles is compared in many studies. Two particularly useful analyses are the National Petroleum Council [Appendix E, 1993] report and the Chang *et al* [1991] study.

comparison, reformulated gasoline is expected to reduce ozone formation 20 percent relative to conventional gasoline.) Methanol and ethanol fuels offer little or no ozone reduction advantage relative to reformulated gasoline. While the reductions in percentage terms are large, the impact in air quality in urban areas would not be affected much, because emissions performance standards tend to equalize actual emissions performance and because the baseline emissions rate is small.

LPG and CNG vehicles achieve substantial reductions of carbon monoxide (CO), from 60 to 85 percent less than reformulated gasoline, methanol, or ethanol according to the National Petroleum Council [1993]. However, while CO emissions were a problem in many cities in the recent past, CO nonattainment is diminishing rapidly due to the replacement of older vehicles in the fleet with new lower emission vehicles and increased use of oxygenated gasoline.

The impact of switching to alternative fuels on carbon dioxide emissions (CO₂), one of the gases associated with the greenhouse effect, is modest. LPG and CNG reduce CO₂ about 25 percent, according to Chang *et al* [1993]. Reformulated gasoline, methanol and ethanol (made from corn) would have roughly the same impact on the formation of CO₂ as today's conventional gasoline.

Electric vehicles would reduce all vehicle emissions, though these decreases would be offset, at least in part, by increases in powerplant emissions. The net result depends on the powerplant's fuel as well as its emissions control equipment.

Finally, though not the focus of the larger federal or state programs designed to increase use of alternative fuels, replacing diesel fuel with CNG or other alternative fuels in trucks and buses would reduce particulate emissions. Similarly, substitution of alternative fuels for gasoline or diesel changes both the mass and composition of air

toxic emissions. As reported by the National Petroleum Council [1993], substituting methanol for gasoline, for example, reduces 1,3 butadiene and benzene emissions but increases formaldehyde emissions. CNG and LPG have low formaldehyde, 1,3 butadiene, and benzene emissions.

While tests show differences in emissions, whether an emissions benefit is realized in the marketplace depends on regulatory processes. Under broad performance standards on tailpipe emissions, the vehicles produced to these standards (excepting electric cars) would perform equivalently, no matter what the fuel. The current advantage of CNG is partly a function of the regulatory focus on tailpipe emissions, and the possibility that for some vehicle categories ULEV standards will be met more easily by CNG than by gasoline vehicles.⁴ Alternative fuels have no inherent emissions reduction advantage under fuel neutral performance standards. Some alternative fuels may be able to meet a performance standard more easily, though, thereby reducing the cost of emissions control. This advantage would have to be weighed against the higher cost and other performance disadvantages of alternative fuel vehicles.

Even granting that alternative fuels can offer some environmental benefit, they might not be the least cost way to achieve such improvement. In fact, other emission reduction strategies appear more attractive, either because the emission reductions are potentially larger or because they are less costly. For example, strategies that are focused on the small subpopulation of high emission vehicles are more sensible than indiscriminately replacing a clean operating gasoline vehicle with a CNG or electric vehicle. In fact, alternative fuel vehicles generally are not attractive on a cost-effective-

⁴ Though achieving ULEV standards with gasoline vehicles will be difficult and expensive, substantial progress has been made, particularly for the smaller sized vehicles. A gasoline powered Honda Accord using variable intake valve timing and precise computer control of combustion recently was certified to ULEV levels.

ness basis. Most studies indicate that the cost-effectiveness of methanol (Lareau, 1989 and Krupnick and Walls, 1990) is very poor, tens to hundreds of thousands of dollars per ton of reduced VOC emissions. Electric vehicles also are not attractive by cost-effectiveness criteria without assuming breakthroughs on battery technology.

Finally, reformulated gasoline is a cost-effective means of reducing vehicle emissions and generally is a better environmental choice than alternative fuels. There are three underlying reasons for this claim. One, while alternative fuel vehicles have lower emissions in some cases, the absolute difference in emissions relative to a recent vintage vehicle operating on reformulated gasoline is small. This reflects significant successes in vehicle and fuel improvements over the last few years. Second, reformulated gasoline currently comprises 25 percent of the total gasoline market. In contrast, a gradual conversion to alternative fuel vehicles would have little noticeable impact on emissions inventories for many years. Finally, the cost of owning and operating alternative fuel vehicles generally is greater than the cost of gasoline powered vehicles.⁵ Because they have only modest emissions reductions yet cost more, alternative fuels (excepting, possibly, LPG and CNG in high mileage fleet or heavy-duty applications) are not cost-effective environmentally relative to reformulated gasoline.

The preceding discussion indicates that both conventional vehicles using reformulated gasoline and alternative fuel vehicles offer improved environmental performance in the future. However, which of the alternative fuel technologies is superior in the long-term is not obvious, given economic and technological uncertainties. Consequently, while the government has a legitimate responsibility for environmental quality, regulators should not exercise their power by attempting to pick

⁵ The exception is LPG in high mileage fleet applications, where the lower cost of LPG fuel more than offsets the higher cost of LPG vehicles.

and support the fuels they think will be winners. Rather, government should develop fuel neutral environmental standards and let the market choose the best vehicle-fuel combination(s). In such a fuel neutral marketplace, alternative fuels likely would have a role. For example, under California's stringent ULEV emissions standard, CNG may be more cost-effective than conventional vehicles in some vehicle categories. Similarly, expansion of the niche market for LPG has potential. As technology changes, relative performance and costs also will change. Subsidies for particular fuel technologies make it more difficult for the market to adapt quickly and efficiently to such changes.

III. Other Rationales for Subsidizing Alternative Fuels

Increased use of alternative fuels may have impacts on employment and technological change. Often these effects are cited erroneously as alternative fuel benefits. Proponents of this view are confusing inputs (the labor or investments needed to meet environmental requirements), which are costs, with outcomes (increased production of goods and services). This error is compounded when the investment and job creation impacts in one sector are considered alone, without recognizing the diminished use of these resources in other sectors. Attempting to justify policies in this fundamentally flawed manner can only lead to reduced economic growth and cost-ineffective programs to improve environmental quality and/or energy security.

A. Job Creation

Proponents often argue that job creation is another reason for a region to provide financial incentives to encourage increased alternative fuel sales. For example, in California, a UCLA study⁶ is cited often to support the claim that many jobs would be created by manufacturing electric vehicles locally. There are two problems with this argument.

First, while demand for alternative fuel vehicles increases due to government intervention, the demand for other goods decreases. Specifically, jobs in the traditional auto manufacturing and auto supplier industries would shrink. In addition, to the extent that alternative fuel vehicles are more expensive than conventional gasoline vehicles, consumers will have less of their income to spend on other products. Businesses will have higher transportation costs. Both of these income reducing effects will lead to job losses throughout the economy.

The argument that job creation is a benefit of establishing an alternative fuel vehicle industry is wrong. The public is best served when vehicles (alternative or conventionally fueled) are manufactured where they can be produced most inexpensively. Thus, if a region does not have a cost advantage relative to other parts of the country, it will suffer a reduction in income if it attracts an industry by offering subsidies that reduce taxpayers' disposable income. There is no payoff from enticing a high cost subsidized industry to locate locally. Even assuming alternative fuel vehicles are successfully marketed, eventually they will be made where it is cheapest to make them, unless subsidies are continued indefinitely.

Second, even if the net impact of government policy is an increase in employment, job creation should not be counted as a benefit. Simply stated, the use of

⁶ Allen Scott, ed., "Electric Vehicle Manufacturing in Southern California: Current Developments, Future Prospects," 1993.

labor in a business is a cost to that enterprise, not a benefit. The fundamental tradeoff, environmental and/or energy security benefits versus the cost of switching to alternative fuels, should be the basis for determining the desirability of alternative fuels. Jobs will be gained and lost in different sectors. These changes in employment involve changes in wage payments that are a cost, not a benefit. Confusion over this point can lead to undertaking uneconomic projects to provide what amounts to less productive employment. Society only gains when a policy causes an increase in the net output of goods and services, or provides net benefits so that the value to citizens of improved environmental quality or energy security outweighs the costs. Jobs generated by a new, government supported industry reduce society's well-being if the investment and payroll costs exceed the environmental or energy security benefits or if job losses in other sectors offset the job gains.

It is worth noting that macroeconomic simulations of the impact of environmental regulations demonstrate that over the long-run, environmental regulations slow the growth of the economy. Two major studies, Hazilla and Kopp [1990] and Jorgenson and Wilcoxon [1990] conclude that past environmental regulation reduced GNP growth. This environmental regulation may or may not have been justified, but it certainly has not been a net job creator. Similarly, producing alternative fuel vehicles rather than conventional fuel vehicles, is unlikely, in net, to create jobs.

B. Advancing Technical Progress and International Competitiveness

Recently, eastern state regulators have argued that forcing the advancement of technical progress in alternative fuel vehicles is an uncounted benefit of the Ozone Transport Commission's recommendation to adopt the California Low Emission Vehicle (LEV) standards. Under the LEV program electric vehicles could be mandated by individual states and some state regulators consider CNG vehicles an attractive

technology to meet the ULEV phase of these standards. Consequently, these state regulators believe that the alternative proposal of the automobile manufacturers to substitute a 49-state LEV standard, which would not require electric vehicles or ULEVs, is inferior, because the technology forcing features of the Ozone Transport Commission's program would be abandoned. This notion that technology forcing alternative fuel vehicle development is a benefit is fundamentally wrong.

Similarly, proponents sometimes argue that governmental technological support provides an ancillary benefit in the form of enhanced international competitiveness in the environmental equipment sector. While government support can make an industry more competitive internationally, as illustrated by European support of its commercial airplane manufacturing industry, this outcome is not necessarily economically desirable.

Similar to the previous discussion of job creation, increased rates of technical change and improved international competitiveness arising from government mandates or subsidies are not benefits. Instead, increased technological activity to meet an environmental goal mandated by government reflects increased investment costs. As Thomas Hopkins [1992] points out, the "technology-as-benefit" contention implies that one of two false premises are true. First it implies that industry, by itself, will not invest properly to ensure that the right technologies are supported. It says, in effect, that the government can better choose which technologies are more meritorious. The observation that government's track record is abysmal should make one suspicious of any argument that directed technical change is a good idea. Second, technical innovation requires investment, and this is a cost, one that should not be required unless the benefits of improved environmental quality or energy security exceed the investment cost. But mandating a technical goal leaves completely open what the costs will be. It is interesting to observe that technological progress historically fares better under market driven policies than in centrally controlled economies.

Because the rate of technical change is an important factor in determining the rate of economic growth and future living standards, the government should encourage technical change broadly, through tax reform and support for fundamental research. However, the government should not support specific technical change. This is best left to the marketplace, which imposes a discipline by rewarding successful technologies while cutting losses on unsuccessful technologies.

IV. The Economics of Government Intervention

While the above discussion indicates that alternative fuels might provide modest environmental and energy security benefits, government intervention is not justified. Theoretically, intervention is only justified when incremental benefits outweigh incremental costs. This condition can only be met when external costs (in this case, the environmental and energy security costs of petroleum use) are not offset by sound government policies.⁷ Many current government programs address the environmental and energy security concerns associated with transportation fuels. Thus, while not all problems are resolved, substantial progress has been made. Air quality is improving noticeably and energy security concerns are receding. Consequently, the rationale for further governmental intervention to promote the substitution of alternative fuels for petroleum products is weak.

The petroleum industry's role in environmental improvement is significant, with current expenditures on environmental programs exceeding \$10 billion annually. Many programs required by the Clean Air Act – such as vehicle inspection and maintenance and reformulated gasoline – are designed to reduce vehicle emissions. Federal

⁷ Ideally, government intervention corrects market prices so that external costs are transparent to market participants.

gasoline taxes, not earmarked for highway construction and maintenance, have increased 6.8 cents per gallon since 1990. Similarly, ongoing federal energy security programs go a long way towards internalizing any plausible energy security cost associated with petroleum use. The most important of these is the Strategic Petroleum Reserve, which, if used properly, would mitigate price runups during supply interruption periods, and minimize macroeconomic dislocations. Given the level of government and industry commitment, the case for substituting alternative fuels for petroleum is weak – and this is reflected by modest benefits but substantial costs.

V. Problems with Alternative Fuel and Vehicle Subsidies

Proponents embrace almost any mechanism to promote alternative fuels use. Sometimes these mechanisms are disingenuously called “incentives,” but in fact they are subsidies in the sense that one industry is singled out for special treatment. This is both inefficient and shortsighted. It is inefficient because subsidies distort the market’s price signals, leading to higher cost outcomes than necessary. It is shortsighted because the subsidies may end up promoting the wrong alternative fuel. Government interference in the marketplace has a rather inauspicious history – one in which losers, like the synfuels program in the late 1970s, are as likely to be supported as technology winners.

In addition to supporting technology forcing standards that turn out to be mandates for alternative fuels, alternative fuel advocates have supported: (1) direct subsidies, such as tax credits for purchase of alternative fuels or reduction of excise taxes on alternative fuels, and (2) indirect subsidies, such as allowing alternative fuel development costs to be included in the ratebase of electric or gas utilities. Though the specific impacts vary between direct and indirect subsidies, the overall outcome is

more or less the same – consumers pay more for less performance. Each possibility is discussed in more detail below.

A. Direct Subsidies

Federal and state governments directly subsidize the purchase of alternative fuel vehicles and offer differential tax rates on competing fuels. Subsidies alter the relative prices of competing alternative fuels, and, in effect, favor one fuel over another, precluding the marketplace from correctly assessing the relative merits of the competing technologies. If new information becomes available, subsidy rates would have to be adjusted. Perhaps, non-subsidized technologies would be found to be superior to the chosen subsidized technology. Policy change is not easy and government directed support tends to be inflexible once established. Vested interests make it difficult to back away from earlier commitments. Because our understanding about the cost and benefits of future technologies inevitably shift over time, it is far better to allow the market to determine outcomes rather than the government. In sum, public subsidies could direct investments into the wrong fuels, which then require permanent subsidies to be sustained. The last time the government got involved in a major way in alternative fuel development, it created the Synthetic Fuels Corporation, costing the taxpayer billions of dollars.

Another problem with direct subsidies is that they increase the real societal cost of improving air quality, since alternative fuel vehicles are less cost-effective than many competing options. That is, to achieve a given reduction in tons of emissions, a program that includes alternative fuel vehicles is likely to be more expensive than a program that does not include use of alternative fuels.

While the excise tax subsidy mechanism offers an apparently beguiling way to make alternative fuels cheaper to consumers, reduced excise tax rates on alternative fuels shrink tax revenues. Since most of fuel excise tax revenue is earmarked for highway construction and maintenance, the reduction in revenue implies one of two outcomes. Either some other tax is increased to make up the difference or highway spending is cut. The consumer pays the cost of the subsidy either way.

B. Indirect Subsidies – Ratebasing Alternative Fuel Costs

Electric and gas public utilities in California have requested rate increases of hundreds of millions of dollars to promote alternative fuel use. These requests go far beyond the amount necessary to cover the cost burden of the Energy Policy Act's alternative fuel vehicle purchase requirements for utility fleets. Though it now appears that only part of the rate increase request will be approved by California's Public Utility Commission, utilities in other parts of the country are proposing similar indirect subsidies to their public utility commissions. Among some of the possibilities for ratebase subsidies are: (1) incentive payments for purchase of alternative fuel vehicles; (2) financial and technical assistance to build fueling facilities; and (3) below cost rates for natural gas or electricity. These requests cannot be justified on an economic basis.

Billing electricity or natural gas customers for expenses associated with the efforts of utilities to promote alternative fuel use is patently unfair. If there are environmental or energy security costs associated with the use of petroleum for vehicle transportation, it is those users, not ratepayers who should pay more. Why should a consumer's electric or gas bill go up to pay for subsidized gas or electricity to run alternative fuel fleet vehicles which are required by the Energy Policy Act? Similarly, why should ratepayers pay higher utility bills to pay for utility company sponsored rebates on alternative fuel vehicles? Ratepayers do not derive any direct benefit of

these subsidies and should not have to bear the cost burden – it is fleet owners who will buy alternative fuel vehicles and alternative fuels.

A second problem of ratebase subsidies is that they can tilt outcomes in favor of the electric or natural gas alternatives. With millions of alternatively fuel vehicles mandated for fleet use by the Energy Policy Act over the next few years, distortions induced by ratebasing could shift demand away from other more economically attractive options. Specifically, LPG, which is not sold by utilities, could be adversely affected by ratebase subsidies relative to electric or CNG vehicles. This is undesirable, since LPG would otherwise be quite competitive (both conversions and OEM vehicles for LPG are less expensive than CNG).

Finally, ratebase subsidies may place utilities in direct competition with independent fuel providers, who are not subsidized. There are significant regulatory difficulties for a Public Utility Commission in ascertaining whether a utility's service station would be as efficient as an unregulated competitor or in ascertaining whether the utility would provide some services below cost. Requiring ratepayers to cover the cost of a utility's construction and operation of electric charging stations or CNG refill stations is not necessary. Instead, entry of unregulated entities should be encouraged to provide this service. Even when the fuel price is identical to a competitive price, the utility has the advantage of a lower cost of capital relative to an unregulated firm, who must build a larger risk premium into its capital investment decisions. When a Public Utility Commission approves a utility's request to use the ratebase to finance new ventures, the utility, in effect, is granted risk-free capital. The end result is that the utility's efforts to develop new markets are subsidized, since the investment is guaranteed a return. Public Utility Commissions should not allow ratebase subsidies which allow utilities to develop new businesses at the expense of other, potentially more efficient, competitors.

Besides being unfair, ratebase subsidies may lead to a situation where the less efficient (but subsidized) party survives. If the utility provides fueling services below cost as a result of a ratebase subsidy, competing private firms can be put at a competitive disadvantage and perhaps fold (or never enter the market), even if their fueling service cost is less than the utility's fueling service cost.

VI. The Level Playing Field Principle

The goal of reducing vehicle emissions is best achieved by promoting competition among alternative vehicles and fuels. The appropriate role of government is to set emissions performance standards and ensure a level playing field on which alternative fuel technologies and reformulated gasoline compete on their merits. Cost-effective low emission vehicle-fuel technologies will prevail. In some situations, alternative fuel vehicles may gain a foothold. Many fleet vehicles in high mileage applications already have been converted to LPG to take advantage of lower fuel costs. Alternative fuel vehicles need not be subsidized. Subsidies for alternative fuels that cannot compete on their own can delay innovation in more promising technologies and adversely influence what fuel prevails.

While the general performance properties and the cost of alternative fuel technologies are known now, which alternative technology is most viable in the long-run is speculative. The viability of the competing alternatives depends on future energy prices, inventions and changing consumer preferences, each of which is uncertain. Consequently, government policy should focus on setting appropriate environmental standards and avoid subsidizing particular technologies. The unobstructed marketplace will more wisely determine which vehicle technology is best in the long-run.

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