

# ***Winning the Oil Endgame*** **Frequently Asked Questions**

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## **OVERVIEW**

***Q.*** ***What's the central thesis of your new report, Winning the Oil Endgame?***

***A.*** Over the next few decades, the U.S. can get completely off oil and revitalize the economy. Since this transition can be profitable, it will be led by business. Our business strategy for adopting innovative technologies and new business models will increase national competitiveness and improve national security. Our study does five things for the first time (to our knowledge): it adds up the modern potential to save and substitute for oil; shows how to eliminate not just imported but also domestic oil; shows how to do so at a profit (making sense even for oil companies); shows how to do it through free enterprise; and shows how to integrate civilian with military needs and opportunities to eliminate oil dependence.

***Q.*** ***How can this be accomplished?***

***A.*** Our strategy for the American transition beyond oil has four interdependent pillars:

1. *Get off oil.* Efficient use can save half the forecast 2025 oil use at an average cost below \$12 per barrel (in 2000 dollars)—less than half the government's \$26/bbl forecast price in 2025, and a fourth of the recent price. Domestic biofuels can substitute for another fifth of the oil (~3.7 million bbl/d) for under \$26/bbl. The rest can be provided by domestic oil from currently available areas, or displaced by saved natural gas—preferably via hydrogen for the highest efficiency and profit. This strategy would save a net \$70 billion per year by 2025, compared with simply buying oil at \$26/bbl, and would also avoid the oil's insecurity, price volatility, depletion, and pollution.

2. *Revitalize the economy.* This oil-displacing strategy will also renew America's car, truck, and airplane industries, all of which are under competitive threat, by speeding their adoption of oil-saving technological innovations. Forging these new tools for eliminating oil will also make those industries more profitable and globally competitive. The same is true for rural economies, where farming fuel is more profitable than farming grains. This economic revitalization will not only save one in ten U.S. jobs from being wiped out by foreign competition; it will add another million new jobs, one-fourth in manufacturing and three-fourths in rural and small-town America.

3. *Adopt policies that support, not distort, business logic.* Automotive and energy industries are global enterprises driven by competitive forces, so market transformation can and ultimately will occur even without new policies. However,

we want to accelerate the transition, not only to strengthen national security and the economy sooner, but also to ensure that U.S. companies are in leadership positions for the 21<sup>st</sup> century. This can happen more surely with the policy innovations we propose—market-oriented without taxes, innovation-driven without quotas, self-financing, and not dependent on much if any new federal legislation. Under these new policies, not only will automakers make more money, but customers will have more and better choices. Your SUV will be peppier and safer, yet use nearly three-fourths less fuel. Your plane ticket will cost less, but you'll get there just as fast and even more comfortably. The goods you ship by heavy truck will arrive as quickly, at lower cost, using less than half the fuel. And all forms of mobility will be freed from dependence on insecure oil supplies at volatile prices.

4. *Build real security.* The Pentagon can lay the foundation for a secure, post-petroleum America by focusing more of its R&D on ultralight structural materials—vital to its own as well as to civilian needs—and by requiring, designing, and buying superefficient military platforms. A more efficient and effective military can then focus on protecting American citizens, not foreign oil supplies, while supporting and deploying the innovations that eliminate oil as a source of conflict.

***Q. Doesn't this take major technological breakthroughs that haven't happened?***

**A.** No. Though this may surprise some who haven't been paying attention to the latest developments, our analysis relies only on technologies that are already commercial or being routinely commercialized, not on any inventions yet to be made. Whatever exists today is possible, and we systematically apply the best 2004 technologies within profitable business models.

The most important technological shift is to apply aerospace technology to road vehicles, and do so at reasonable cost. Because only 12% of fuel used in a typical light vehicle actually gets to the wheels, if you save 1 unit of energy at the wheels, you save 7–8 units of fuel in the tank. Three-fourths of the fuel use by cars and light trucks is caused by their weight. New materials, such as carbon-fiber composites, can cut that weight in half, yet can also increase safety by absorbing up to twelve times as much crash energy per pound as steel can do. *Making cars and trucks both lighter and safer, regardless of their size, is the place to start—we need not rely on the fuel cell to achieve oil independence.* (However, an eventual shift to a hydrogen economy would also become much cheaper, easier, and faster with superefficient vehicles. They'd solve the supposed hydrogen storage problem not by any new storage technology, but simply by making the vehicle so efficient that it can travel as far using severalfold less hydrogen.)

In biofuels, the shift from fermenting starchy plants like corn to producing ethanol from woody plants like switchgrass and poplar is just now at the commercialization stage, with the first pilot facilities being developed in Louisiana, Colorado, and Hawai'i. By using more of the plant material, these new "cellulosic ethanol" processes double the yield, yet have lower capital cost and far lower energy use per gallon of fuel produced, so they can displace a fifth of projected 2025 oil use without subsidy. This wouldn't raise land or water problems, nor interfere with producing food crops.

***Q. Who is going to take the lead on this?***

**A.** All sectors of society—business, government, the military, and consumers—have important roles to play. Oil has been the source of our society’s strength, but oil dependence is now becoming our greatest weakness. It’s everyone’s problem, and everyone can contribute a piece of the solution. Business needs to change its business models and investment patterns. The military needs to lead the R&D that supports force transformation and that helps create a new cluster of advanced-materials industry, much as military R&D gave birth to the modern semiconductor industry. Consumers should be offered new choices and given the information and responsibility to choose wisely. The federal government should lead, follow, or get out of the way: state governments have at least as important a role as Washington, and could even do the whole job if necessary.

***Q. Why should U.S. business do this?***

**A.** America’s core transportation-equipment industries—automaking, truckmaking, and aircraft—are all struggling against foreign competition. It’s clear that their customers want equipment that’s more fuel-efficient but without compromise and at similar cost. The advanced-technology Class 8 (18-wheeler) trucks described in our report could double commercial fleets’ trucking margins from 3% to 6–7%, with an Internal Rate of Return around 60%. The advanced cars and light trucks we analyze, saving on average 69% of the fuel at a cost equivalent to buying gasoline for 57¢ a gallon, could save each owner \$1,000–1,800 per year in fuel bills and repay their extra cost in three years (or immediately with the “feebates” we suggest). The more efficient planes that Boeing is now selling could save U.S. airlines billions of dollars per year and help forestall bankruptcy. So if customers want it, business should provide it. We show how this can make sense and money for everyone, and how to make it happen faster.

The new technologies also enable new, more flexible, and cheaper production methods that can underpin new business models for the automotive sector. This will have quick paybacks for customers, so will be profitable to implement and can earn better margins than Detroit earns now. We need to do this right away: other countries are not going to wait for us. Japan and Europe are eager to eat Detroit’s lunch today, and China intends to follow quickly, becoming a major car exporter by 2010 and probably exporting breakthrough technologies, not your uncle’s Buick.

***Q. How long will it take?***

**A.** It will take several decades for the U.S. to get completely off oil, but we can be more than halfway there by 2025, using only 13 million barrels per day, vs. the 28 Mbbl/d forecast by the government. Getting into this oil trap took us several decades, and the stocks of vehicles turn over slowly. Nonetheless, *the end of U.S. oil dependence could be only about as far in the future as the Arab oil embargo was in the past.* And while buying more oil has already cost the economy more than \$2 trillion in imports—currently running \$120 billion a year—buying less oil, ultimately no oil, will *save* \$70 billion a year more than it costs to achieve.

As a reality check, if every car (not light truck) on the road today were as efficient as the new hybrids like the Toyota *Prius*, they'd displace the amount of oil we currently import from the Gulf (2.5 million bbl/d). If every car and light truck on the road in 2025 were as efficient as the best 2004–05 hybrid cars and SUVs, they'd save two Gulfs' worth, or one-sixth of the total oil forecast to be used by the United States.

We know that saving a lot of oil quickly is possible, because we've done it before. The last time the United States paid attention to oil efficiency, after the 1970s oil shocks, the equivalent of Gulf oil production was saved every two and half years (at a given level of GDP). Specifically, during the eight years 1977–85, GDP grew 27%, but oil use *shrank* 17%. Oil imports fell 50%; oil imports from the Persian Gulf fell 87%. The rate of improvement assumed in our study is about two-fifths slower than that, and our rate of improving light-vehicle efficiency is also slower than Detroit achieved back then.

***Q. If these technologies are available, why isn't more happening right now?***

**A.** The efficiency revolution in transportation has already started. Hybrids, like Toyota's 55-mpg *Prius* midsize sedan, already account for 1% of the vehicles sold in the U.S., and this share is expected to double next year—though few of those vehicles will be U.S.-made. Three percent of Toyota's entire worldwide production next year will be hybrids, and Toyota plans to open additional hybrid factories in Japan and China. What we found is that if you use advanced materials to make these hybrids ultralight and even safer, then you get nearly redoubled efficiency at approximately zero extra cost.

The industry is already starting to adopt advanced materials. BMW is manufacturing carbon composite materials for the roofs of its top-of-the-line vehicles to make them light, stronger, safer, better-handling, and more fuel-efficient. Nor need we rely on composites: steel companies have shown how new lightweight steels could double fuel economy and improve safety at no extra cost.

The same thing is happening in fuels. Biofuels are 2% of U.S. fuels today, but have already displaced one-fifth of gasoline in Brazil (where they compete well without subsidy), and are rapidly rising in Europe, which last year made 17 times as much biodiesel as the U.S. did. The more savvy oil companies like BP and Shell are already starting to invest in and distribute biofuels as a new product line.

The real shift is just over the horizon. As industry adopts these innovative technologies for mainstream products, adoption will adopt the mass-market scale that is needed to win the oil endgame. We're already seeing Honda and Toyota selling and announcing hybrids for their most popular sedans—the *Civic*, *Accord*, and *Camry*. Ford is introducing its *Escape* hybrid SUV; GM and DaimlerChrysler are introducing "mild hybrids" in some light trucks. The same thing will soon happen with lightweight materials and aerodynamic design, for two simple reasons: the public wants it, and it's profitable.

***Q. Aren't you relying on policies to make this happen, which conflicts with your market-led approach?***

**A.** The market is already adopting technologies to provide greater fuel efficiency in cars and planes—just look at the hybrids offered by the Japanese, and the new *7E7*

*Dreamliner* offered by Boeing (one-fifth less fuel, same or lower price). We can just let the market operate, or we can institute policies to help the transition happen faster and more surely, for two reasons: to accelerate key security and other national benefits, and to enable U.S. industries to take a leadership position before their competitors overtake them irreversibly.

Our policies rely on neither gasoline taxes nor automotive fuel-efficiency standards. This is not the usual federal program telling you what to do and then subsidizing the things you wouldn't want to do otherwise. The policies we propose will make the transition beyond oil cheaper and faster, and will end up saving the federal government money, thus reducing the budget deficit.

The most important policies to accelerate the \$150 billion in annual fuel savings are feebates, and R&D support for advanced materials and biofuels. The most important policies to enable the industries at the core of our economy to participate fully are loan guarantees to help convert existing factories, retrain workers, and build new factories, and smart government procurement of efficient vehicles to cut about three years off the technological transition time. The most important policy for social equity, especially for equal employment opportunity, is our scrap-and-replace proposal for giving low-income families access to affordable personal mobility.

***Q. \$180 billion seems incredibly expensive. How practical is this?***

**A.** Well, \$18 billion a year to propel the U.S. into a 21<sup>st</sup> century leadership position by retooling America's factories to build more efficient vehicles and developing our domestic fuels infrastructure is modest by comparison to other national priorities. It's what we're spending right now on oil imports every eight *weeks*. If we spent the money it takes to occupy and rebuild Iraq for one year on rebuilding our auto industry instead, we'd eliminate forever the need to import oil from the entire Persian Gulf. We spend \$120 billion a year on Gulf imports, \$40 billion on homeland security (partly oil-related). So it's really a matter of national priorities and corporate strategy. We prefer priorities that put American security and prosperity first, deliver more jobs and superior services to our fellow-citizens, and are driven by the logic of the marketplace—best buys first.

Our analysis didn't rely on all the hidden costs of oil—military, economic, environmental, geopolitical—but valued these all at zero. We found that saving or substituting for all the oil America uses is cheaper than just buying that oil at the current or future market price. So what are we waiting for? Let's capture those profits as soon as possible!

***Q. Is this really feasible?***

**A.** Yes. The five co-authors have 70 years' combined experience in the energy-supplying and -using industries, with which we conferred extensively throughout our research. The technologies are already on or entering the market. And our proposals can be accomplished with little or no new federal legislation, thereby avoiding gridlock.

## STUDY FUNDING

***Q. How did the Pentagon come to fund this study?***

**A.** The Office of the Secretary of Defense and the Office of Naval Research, along with the Hewlett Foundation, are the primary funders of this research. (A conservative private foundation and individual donors also contributed significantly.) All of the funders are listed in the report. Only the authors, not the funders, are responsible for the views expressed in our report.

The Pentagon is interested in two main issues: are there coherent and attractive strategies for reducing U.S. vulnerability from dependence on foreign oil? Are there economically viable opportunities for our armed forces to reduce their logistical fuel burden, thereby increasing force effectiveness? The answer we found to both questions is yes.

***Q. Who has been briefed on this?***

**A.** In OSD, Assistant Secretary of Defense Dr. Linton Wells II, and the Director of Naval Research, Rear Admiral Jay Cohen, have been kept informed during the research process. Vice Admiral (USN, Ret.) Arthur K. Cebrowski, who leads Military Transformation for the Secretary of Defense, was briefed in July, along with other federal agencies. Dr. Wells and other senior civilian military leaders were privately briefed last week on the final results. At the advent of this launch, we will be holding briefings at the National Defense University later this week, as well as at the Center for Strategic and International Studies, a private group of national-security experts.

## BUSINESS ADOPTION

***Q. Great ideas, how are they going to be implemented?***

**A.** Adoption of disruptive new technology typically occurs in three phases. The first phase involves research and development—in this case, mainly on advanced techniques for manufacturing ultralight structures, such as carbon-fiber autobodies, and for producing biofuels from woody plants. We suggest that this R&D be a partnership between industry and government, including DoD.

The second phase involves new product introduction and adoption, both to educate customers and to build experience and scale. Business will lead this phase based on its own competitive imperatives and profit motives.

The third phase is mass adoption across society, as in Geoffrey Moore's *Crossing the Chasm*. This phase is led by customers and the businesses that serve them. A few well-chosen policies, such as feebates to speed adoption of advanced-technology vehicles, loan guarantees for converting Detroit's auto plants to make them, and technology procurement with special rewards for early market entrants, will help accelerate implementation, but implementation would eventually occur even without these policies. The main goals of speeding implementation are to save more oil sooner, improving national security and the economy, and to ensure that the car, truck, and

airplane industries retool before they get outcompeted. *The U.S. could import efficient cars to save imported oil, or could make the efficient cars itself and end up importing neither cars nor oil.* We prefer that outcome.

***Q. This plan sounds so very complex—what needs to happen first, second, third, to move it towards implementation, and what is RMI doing to ensure that others pick up your plan and run with it?***

**A.** Actually, getting started is arrestingly simple. The first step is to redirect our research and development efforts to the most critical technologies that will go the furthest to reduce our reducing our nation’s dependence on oil. Military leaders will speed their own forces’ transformation by promptly laying its foundation in superefficient platforms and lean logistics. We recommend the U.S. military fund the R&D needed to create a new cluster of advanced materials industries, and that these technologies be shared with the civilian sector, in much the same way that DoD earlier created the modern semiconductor industry. RMI is briefing the Services regarding the opportunities to improve fuel efficiency and force effectiveness, and there is gratifying interest.

At the same time, modest additional funding is needed to consolidate and refine recent advances in biofuel technologies so they can attain full production without subsidies. (Recent pilot plants show encouraging results and now need the next stage of scale-up and maturation.) Both oil and agricultural companies have a business interest in seeing competitive biofuel prices. RMI is advising the oil industry, where its principals have long served as consultants, on these and other promising technologies and on how they can address the industry’s strategic concerns.

The second step is business adoption, particularly by the transportation equipment sector. Making superefficient cars, trucks, and airplanes—the tools for getting the country off oil—is also the key to these industries to survive and prosper. (In aerospace, Boeing has already bet its future on the fuel-efficient new *7E7 Dreamliner*.) RMI has been engaged in technical and strategic conversations in all three of these sectors, most of all in the auto industry, and is encouraged by the initial response to our proposals in *Winning the Oil Endgame* for securing U.S. automakers’ competitive advantage, increasing their profits, and expanding their customers’ choices.

***Q. What's the biggest hurdle to realistically setting this plan in motion?***

**A.** *The biggest hurdle is not technological, it's the management challenge. It's our beliefs that hold us back.* Harvard’s Clayton Christensen said it best in *The Innovator’s Dilemma*: “Large corporations focus on incremental sustaining innovations that support their best existing customers, not the disruptive innovations that create new customers or entirely new services.” SUVs are sustaining innovations; uncompromised, ultralight, ultrasafe, and ultraefficient vehicles (like the 66-mpg midsize SUV design we analyzed, saving fuel at a cost equivalent to buying gasoline for 57 cents a gallon) are disruptive. The choice is simple and stark: either adopt the innovative technologies and business models to become the leaders in the 21<sup>st</sup> century, or join the scrap-heap of the 20<sup>th</sup> century by importing both foreign oil *and* efficient foreign cars. Of the 12 original Dow Jones companies at the beginning of the 20<sup>th</sup> Century, only General Electric has survived;

the rest went to compost. We wouldn't want American automakers, and the million-plus high-wage jobs they support, to suffer the same fate.

***Q. If some of your recommendations are adopted, but not others, is that a true net gain, or is its strength based on the whole in its entirety?***

**A.** If any of the elements of the plan are adopted, then we will have taken a step forward to ending oil dependency. As former Secretary of State George P. Shultz says in his Foreword to *Winning the Oil Endgame*, it's a bit like baseball: home runs are wonderful, but the games are usually won by single and doubles, good pitching, and good fielding. But our strategy works better as a whole than piecemeal. There are synergies between technology, business strategy, and government policies that accelerate what the market will ultimately bring to us, and this acceleration benefits the whole country. Each time oil prices rise \$1, the U.S. sends abroad another \$7 billion, most of which never returns. The sooner we bring those dollars home and invest them in ourselves, the better. Even at the low oil price that the government forecasts for 2025 (\$26 a barrel in 2000 dollars), the prize at stake is our national security, the competitiveness of our core industries and of our farming and ranching economies, and a \$70-billion *annual* net saving by 2025. That's a prize well worth striving mightily to win.

## **INDUSTRY REACTION**

***Q. What does the auto industry say?***

**A.** Advance copies of this report have been sent to the senior management of each of the Big Three and are currently being reviewed. During the course of this report, we had extensive technical discussions with these and other firms that make cars and trucks. Many of the experts we consulted are gratefully acknowledged in our report. Our report underwent extensive peer review, and was sent in draft, in whole or in part, to 139 peer-reviewers in industry, government, and the military.

The initial response has been encouraging. Our report addresses automakers' strategic concerns and highlights technological approaches they may not have considered as fully or in the same light. At the time of release, none of the automakers had made official comments either favoring or disputing the contents of our report. We anticipate further constructive dialogue with them, as we are already conducting with major oil companies. Our research is sufficiently extensive and original that it may reasonably take some time for these firms and industries to form a considered opinion. We will be glad to work with them to make sure they understand what we've done, to respond to any queries they might have, and to receive gratefully, as we did during the peer-review phase, any clarifications or corrections they may offer. From this dialogue will emerge a better mutual understanding of how best to proceed.

***Q. So much hinges on redesigning the automotive, trucking, shipping industries..though we know this is already happening (See, for example, The***

***Economist's cover story this week). Have they embraced your plan? Can you provide names in these sectors who support your findings? Were they consulted during the writing?***

**A.** Manufacturing flexibility is a strategic imperative for the automotive sector due to the fragmentation of consumer demand, and the diseconomies of scale in large, inflexible factories with high fixed costs. Carbon composites offer more than just halved weight and superior crash performance; they also offer a breakthrough in the manufacturing process that dramatically reduces parts count and assembly complexity. The body shop can virtually disappear; the paint shop can become optional. This materials shift can reduce the capital needed for an auto plant by at least two-fifths from today's best practice (from ~\$6,100 to ~\$3,700 per vehicle/year), and decrease the minimum efficient size of a plant by at least threefold (from 150,000 to 50,000 vehicles/year). All these elements make these factories more flexible. Remember, disruptive technologies enable new business models, which are vital at this critical stage in the transportation equipment industries' competitive evolution.

Our communications staff can put you in touch with sectoral experts in the transportation-equipment and oil industries on request, depending on your needs.

***Q. What about the non-automotive industries? How does this affect general business?***

**A.** All businesses directly or indirectly use energy, and all of them have opportunities to reduce their energy use through cost-effective efficiency, and thereby increase profits at low risk. For example, in the trucking industry, fuel accounts for 45% of the variable costs. Replacing the fleet with modern trucks would cut the fuel bill in half, double trucking companies' profits, and lower costs to all sectors of society. At a national level, fuel savings are just like a massive \$130-billion-a-year tax cut, providing each person, on average, with at least \$1,000 more in annual disposable income.

***Q. Biofuels require extensive subsidies, how can this be good for both farmers and for energy consumers?***

**A.** Biofuels made with today's technologies require extensive subsidies, but biofuels made with tomorrow's technologies will not. When we switch from starch-based fermentation to cellulose-based enzymatic reduction or gasification, we double the yield of ethanol for each ton of feedstock. That means that cellulose-based biofuels will be cheaper than gasoline, producing ethanol at the equivalent of 55¢/gallon of gasoline and thus benefiting consumers.

Farming biofuels can earn more money than farming food. Today, farmers earn around \$300 an acre farming corn or soybeans. They could earn \$400–600 per acre farming fuel crops like switchgrass, and that doesn't include the \$50–100 per acre from the associated carbon credits and windfarm royalties. At a national scale, we are routing \$40 billion per year from OPEC, particularly the Mideast, to the Midwest to rebuild our nation's farming communities.

***Q. Who will be your biggest critic?***

**A.** We expect to get criticism from both those who are entrenched in their own positions that have led to the policy gridlock we have today. When we do, we'll know that we have the right approach. We may also be criticized by those who haven't yet had the opportunity to read our report (it is, after all, 329 pages of detailed and original research that will naturally take time to digest) and who may make incorrect assumptions about what it says. We hope in time they will respond less reflexively and more reflectively. Our report is meant to advance the strategic interests of *all* the industries whose business cases it examines—specifically, cars, trucks, trucking, airplanes, airlines, and oil—as well as the national interest, and we think it does so. We are pleased that early reactions from industry, government, and military leaders, and from the book's Foreword authors, Secretary George P. Shultz and Sir Mark Moody-Stuart, confirm this.

## **POLICIES**

***Q. What does Congress say?***

**A.** We look forward to briefing relevant Hill staffers later this week and beyond. However, these briefs will be more as a courtesy than to ask for anything, because our policy suggestions don't actually require major if any federal legislation—they could be implemented administratively or even at a state level—and our primary audience is business and military leaders, not legislators or other political leaders.

***Q. Who on the Hill is going to carry the water for you?***

**A.** Rocky Mountain Institute is nonpartisan, apolitical, nonprofit, and does no lobbying, so that wouldn't be an appropriate question for an organization like ours even if we were proposing major federal legislation. We would hope, however, that our effort to launch a new national conversation about oil, security, and the economy would enjoy broad bipartisan support. Our approach should appeal to business, since our policies support not distort business logic; to labor, since our recommendations would create a million net jobs and 21<sup>st</sup>-century high-wage manufacturing; to farmers, since our recommendations could at least triple net farm income; to environmentalists, since we are reducing greenhouse-gas emissions by 26% at no extra cost; to welfare reform advocates, because we are addressing low-income transportation; to fiscal conservatives, because our policies would reduce the federal budget deficit and dramatically cut the trade deficit; and to everyone who cares about reducing oil dependence and strengthening national security. So there should be many motivations to grab a bucket.

***Q. You say that this plan requires no government mandates for success, but relies solely on businesses to lead...but isn't the military part of government, and wouldn't this in turn subject it to congressional scrutiny and approval, say in the funding of a military overhaul, for example?***

**A.** Military budgets are indeed subject to Congressional approval and oversight. What we said was not that no federal *action* is required, but that our approach doesn't depend on much if any new federal *legislation*. We expect that the redirections of military science and technology investments we propose, which are very modest within the DoD budget, would be welcomed and routinely approved by Congress as a smart way to meet military objectives while strengthening the civilian economy. Indeed, laying some of the technological foundations for getting the country off oil forever seems to us one of the most fundamental contributions DoD could ever make to its national-security mission.

**Q.** *What about feebates? Don't they hinge on government intervention? Are they essential to the success of the profit claims you make?*

**A.** Let me respond to your last question first. This strategy can be profitable for business without changing public policy. All the capital investments earn more—often much more—than the companies' cost of capital, all strengthen competitiveness, and all are profitable because they provide real value to customers by replacing fuel cheaper than buying it at the pump. We found that saving half the oil the country uses would cost an average of only \$12 per barrel. Oil prices are now over \$40. It's not a difficult calculation.

Second, feebates are a mechanism to accelerate consumer adoption, and increase the certainty that the mass market will adopt new, more efficient cars without infringing on customers' freedom of choice. Remember, the feebates we propose are revenue-neutral and size-neutral. You're welcome to buy and drive an SUV or whatever other sort and size of vehicle you like. But we want to help the market deliver uncompromised SUVs that get over 60 mpg, and offer you that choice too. We propose to influence your choice by giving you a rebate for choosing an efficient vehicle, or charging you a fee on an inefficient vehicle, compared with other vehicles *in that size range*, so the least efficient large vehicles will pay fees while the most efficient vehicles will get rebates. The resulting shift in how you exercise choice will greatly expand your range of choices in the showroom while preserving and indeed enhancing the other attributes you also want, such as comfort, roominess, sportiness, reliability, and above all safety.

**Q.** *Don't the consumers pay for the extra cost of the technologies?*

**A.** A typical consumer spends \$1,500–2,000 per year on gasoline. The recent run-up in oil prices has cost every one of us about \$500–700 a year. That adds up fast: every time the oil price goes up \$1 a barrel, the nation spends \$7 billion a year more on fuel. The sort of advanced-technology car we propose would save about 73% of the annual gasoline, or about \$1,000–1,800 a year at the pump. We estimate that these cars would cost about 7% more, or about \$2,500 for a midsize luxury SUV. That's a 2–3-year payback, and well within what nearly every credible study has shown to be the range of required payback for consumers.

So, yes, consumers as a group would be paying for the technologies, but as a group they would save far more from lowered gasoline bills than these technologies cost. If feebates were introduced to speed up the sales of efficient cars, the buyers of the 15-

mpg SUV indeed would pay for the technologies in the 66-mpg SUV—which is why feebates would work so well, by influencing customer choice at both ends. But the extra cost of that quadrupled-efficient SUV will pay for itself in three years at gasoline prices well below today's. The feebate will simply help you choose your next car as if you were looking at the fuel savings throughout its 14-year life, not just in the first few years. Moreover, automakers will make more profit under feebates than they do now. And they'll make more of the very efficient and otherwise superior vehicles that the global market is increasingly demanding.

## POLITICS

***Q. If the conservative establishment has proven itself as an obstacle to efficiency (I'm thinking of CAFE standards as an example, or drilling in ANWR), why do you think they will embrace your plan? And, put another way, if this plan puts its faith in the free market, why then haven't these ideas already taken hold with conservative businessmen and -women, and why put your faith in people who have historically held back environmental and even economic progress?***

**A.** We don't accept that characterization, and are gratified by early private responses from conservative commentators who find our reasoning attractive. (The Foreword by George W. Shultz, a staunch Republican who is widely admired across the political spectrum, merits your attention in this regard.)

Spending most of our time working with industry, and being well acquainted with what it can do and how it works, we put our faith in business because we believe that business can be very efficient and effective in providing products and services to consumers and adopting new technologies to do so. According the JD Powers and Associates' 2004 Survey, 80% of U.S. consumers want a large vehicle that is fuel-efficient and has less impact on the environment. It is business's job to give consumers what they want. Customers ultimately rule. This explains why Toyota has taken the lead in incorporating hybrid technology—which will be in 3% of *all* the vehicles Toyota makes next year—and why other automakers are following by placing the technology into their already popular models, such as Honda's *Civic* and *Accord*, Ford's *Escape* SUV, and several of GM's and DaimlerChrysler's light trucks. Today's best hybrids can double fuel efficiency at reasonable cost without your giving up any other driver attribute. Advanced materials are the logical next step that will redouble the fuel efficiency once again, yet make hybrids even *more* cost-effective, because the savings go up but the cost doesn't.

Our view is that U.S. businesses will embrace our plan because it will be profitable to do so, because their competitive posture will strengthen, and because they'll have more and happier customers. That's what business does extremely well, and why we believe the transition beyond oil, rather than being forced by government, will be led by business for profit.