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Introduction

Good day, Chairman Lugar and Members of the Committee. I have the privilege to speak to you today on behalf of the National Commission on Energy Policy (NCEP), a diverse and bipartisan group of energy experts that first came together in 2002 with support from the Hewlett Foundation and several other leading philanthropies. In December 2004, the Commission released a report entitled *Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges*. The first chapter of that report was about oil security because our Commission believed then, and still does, that oil security is one of our nation's foremost economic, national security and energy challenges.

This isn't news to anyone, of course—least of all this Committee. In fact, as national policy obsessions go, America's oil dependence has been one of our most enduring. For more than fifty years, Congress and multiple Administrations of either party have decried our reliance on imported oil and vowed to do something about it. Today, with oil prices topping $70 per barrel and gasoline prices at $3 per gallon, we are again enmeshed in an active debate over energy policy. The lack of real options to address near-term energy prices is a source of great frustration here in Congress and throughout the country. The challenge we face is to move beyond slogans, blame, and false promise of "quick fixes" and seize upon this moment of collective focus to develop long-term policy responses that will meaningfully protect our economy while strengthening our national security.

The basic elements of an effective response to our current oil predicament are as easy to summarize as they are difficult to execute. Put simply, the Commission believes we must:

1. expand and diversify supplies,
2. reduce demand, and
3. develop alternatives

At the outset, I want to stress four themes that I hope will resonate throughout my remarks. First, the elements identified above are complementary components of an effective strategy. If they are not pursued in concert the effort will fail. We must have supply increases and demand reductions. We must pursue greater vehicle fuel economy and aggressive efforts to displace petroleum with biofuels. Simply put, we must move beyond divisive and false choices to develop a comprehensive approach that does not seek to trade one element off against the success of another.

Second, until and unless private markets reflect the full economic, security, and environmental costs of oil dependence—and until and unless consumers possess adequate information to make efficient choices—policies that rely solely on private market decisions will continue to fail. It is therefore incumbent upon government to overcome market barriers and motivate private sector innovation by creating incentives that better reflect the true benefits of greater energy security.

Third, improving our energy security is a long-term challenge. If we commit the nation to a fundamental course correction, a secure energy future is within our reach. It will take several years, however, before we begin to reap the benefits of improved policies and technologies. During this time, the problem of high prices and tight supplies will almost certainly get worse as growth in petroleum demand continues to outstrip the rate at which vehicle fuel economy improves and new sources of oil come on line. While biofuels hold great potential, near term gains will also be incremental when compared against our annual petroleum consumption. If history is a guide, public interest and support for long-term policies will wax and wane as the price of gasoline rises and falls. A real solution therefore will require the kind of commitment, consistency, and courage our nation has mustered in the past when we understood that our future was at risk.

Finally, we must better understand and articulate the risks of oil dependence and establish goals that encourage consistent progress and accountability. I believe that our failure over the past thirty years to implement measures commensurate with the risks is in part due to widely held misconceptions about the true nature and scope of the problem and to our inability to establish realistic interim goals and mechanisms to measure our progress in achieving them.

Rethinking "Energy Independence"

Before delving into solutions, I would like to take on the somewhat heretical task of challenging the aspiration of "energy independence" with its attendant focus on reducing our nation's use of "foreign oil." While emotionally compelling, these concepts are vestiges of a world that no longer exists. By failing to recognize the fundamentally global nature of the oil market, and the increasingly global nature of markets for natural gas, the call for energy independence has become an obstacle to effective policy design. There is one world market for oil. It is a fungible global commodity that has a single benchmark price. Wide disparities in the price of gasoline around the world are the product of national subsidies and taxes, but have nothing to do with how much oil different nations import or produce. *Our* economic vulnerability to oil price shocks is entirely a function of how much oil we use—the continent from which the oil was extracted has no bearing whatsoever on this equation.

Moreover, as members of this Committee know better than anyone else, some of the most profound consequences of America's dependence on oil go well beyond the economic. It's virtually impossible to put a dollar figure on all the costs of that dependence, but there is no question that our thirst for oil constrains our foreign policy, imposes burdens on our military, accounts for approximately for one-third of the U.S. current account deficit which soared to $805 billion in 2005, swells the coffers of undemocratic and even actively hostile governments, and directly or indirectly provides some of the funding for terrorist organizations that mean us harm. These risks and vulnerabilities too, like those

we face strictly in terms of our own economic well-being, will surely continue to grow if we don't take action. Put simply, if current trends don't change we face a global scramble for energy resources within this century that is sure to be economically and geopolitically damaging to all concerned.

Confronted with these realities it is tempting—but wrong—to imagine that if we could only become energy self-sufficient everything would be fine. I can't underscore this point too strongly: energy "independence" must not be confused with energy "security." Energy independence is simply unrealistic and has been ever since President Nixon first proposed to enshrine it as a national goal in the 1970s. U.S. oil imports have been rising inexorably ever since. The United States alone currently accounts for fully one quarter of world oil demand. What may be less well known is that we are also the world's third largest oil producer at present. But this will not last forever. Our nation holds less than 3 percent of the world's proved oil reserves. Sixty-one percent of world reserves, by contrast, are located in the Middle East.

REGION	% OF WORLD'S PROVED RESERVES
Middle East	61.7%
Europe/Eurasia	11.7%
Africa	9.4%
South & Central America	8.5%
North America	5.1%
Asia Pacific	3.5%

* Only 9% of world reserves are held by countries considered "free" by Freedom House.

Current projections indicate that oil production by the United States and other industrialized countries will decline by 6 percent over the next two decades, even as oil production in the former Soviet Union increases by nearly 50 percent and OPEC output increases 33 percent. This means that U.S. oil imports will continue to grow in the future, as they have for the last several decades, and that we like everyone else will increasingly need to rely on oil supplies that originate in what are now unstable and undemocratic regions of the world. Nor will our dependence on foreign sources of energy be limited to oil: given declining domestic production of natural gas—another fuel that plays an extremely important role in the U.S. economy—it appears inevitable that we will increasingly need to rely on overseas sources for natural gas as well. The key, then, to greater energy security for the United States lies in recognizing—and better managing—our fundamental energy *inter*dependence.

Oil Market Fundamentals

Nearly all experts agree about the fundamental drivers behind today's high oil prices and extreme market volatility. For some time now, rising global demand for petroleum—driven not only by growing U.S. demand, but in part by the very rapid modernization of countries like China and India—has been outpacing the discovery and development of new sources of supply. The result is that we now live in a world that requires approximately 85 million barrels of oil daily, but has only very little spare production capacity (as little as 2 percent, according to various estimates) and barely sufficient refining capacity. In this environment even small disruptions along the supply chain can cause serious repercussions. The dynamics are further strained by OPEC's ability to

manipulate production quotas and by the participation of market players that operate on motives outside the bounds of economic efficiency.

Unfortunately, this set of conditions seems unlikely to change soon. U.S. and total world demand for oil are expected to increase substantially over the next 20 years. (See Fig.1) Between 2004 and 2025, U.S. demand is projected to grow 24 percent (from 21 to 26 million barrels per day) and total world demand is expected to increase 34 percent (from 82 to 110 million barrels per day). (In the last year, the U.S. Energy Information Agency has downgraded its 20-year domestic demand projection by 3 million barrels a day based on expectations that high global prices are here to stay.) The world is suffering from what can best be described as a "demand shock" as China, India and much of the developing world modernize their economies and dramatically increase their use of motor vehicles. Equally concerning, there is currently very little spare capacity in the global oil market to make up any shortfall in oil supplies that arises as a result of political instability, unforeseen demand growth, acts of terrorism, or weather-related events. In 2005, global spare production capacity totaled approximately 1.5–2.0 million barrels per day; by contrast spare production capacity in 2001 was approximately 7.3 million barrels per day. This means that any event that prevents even a relatively small amount of oil from reaching today's global markets can have a dramatic impact on prices.

In partnership with the organization, Securing America's Energy Future (SAFE), NCEP has been exploring the potential consequences of today's tight supply margins by examining the impacts of any number of possible disruptions in global oil supply. With help from industry and military experts, as well as from the Wall Street analysis firm Sanford C. Bernstein and Co. LLC, we concluded that any number of truly unexceptional circumstances could cause global oil prices to literally sky rocket. As part of an oil crisis simulation called Oil ShockWave, we found that a mere 4 percent shortfall in daily world oil supplies could lead to a 177 percent increase in world prices. It wouldn't take much, in other words, to send oil prices even higher—perhaps significantly higher—than they already are. With the U.S. transportation system over 97 percent reliant upon petroleum, the impacts of such an increase could be devastating. As then Chairman of the Federal Reserve Alan Greenspan observed in 2002, "All economic downturns in the United States since 1973 have been preceded by sharp increases in the price of oil."

A Better Goal for Oil Security

If we accept that the key measure of our energy security is not how much oil we import, but how much our economy depends on oil, we can begin to articulate more realistic goals and actually set about achieving them. In fact, the oil intensity of the U.S. economy, as measured by gallons consumed per dollar of GDP generated, was cut in half between 1975 and 2000. (See Fig. 2) There were multiple reasons for this decline and they are worth reviewing as we explore our policy options for the future. First, there were structural shifts in the U.S. economy that led to reduced oil consumption, including a shift to less energy-intensive enterprises generally, together with more efficient oil use in some industries and a shift away from oil to different fuels altogether in other industries, notably in the electric power sector. Second, and very important, were vehicle fuel economy standards introduced in the late 1970s that doubled the average mileage of our passenger car and light-duty fleet.

An ambitious goal is to cut the oil intensity of the U.S. economy in half again over 20 years. To achieve this goal would require roughly a 7.25 million barrel per day reduction in oil consumption by 2025. Unfortunately, progress in further reducing the overall oil intensity of the American economy has slowed in recent years, while progress in improving the efficiency of the nation's vehicle fleet has stalled altogether. But for a modest recent increase in light-truck standards, fuel economy requirements for passenger vehicles have been essentially unchanged since 1980. As a result, average fleet efficiency actually began to decline in recent years as large trucks and SUVs captured ever larger shares of the U.S. auto market. Simply stated, the United States will not have a serious policy to increase oil security until we achieve a significant increase in the fuel economy of our vehicles.

A fundamental premise underlying the Commission's oil security recommendations is the belief that we can neither drill nor conserve our way to energy security. We simply must address both the supply and demand sides of the equation if we are to have any hope of lasting success. As Congress and ordinary Americans search for solutions to the current costs of gasoline, it is painfully clear that there are no good near-term options. We must accept this unfortunate reality and direct our attention to minimizing the harmful effects of the oil shocks that are likely to occur with increasing regularity and severity over the next twenty years.

Solutions

As noted at the outset, the Commission believes that there are three essential elements to enhanced oil security: increasing supply, reducing demand, and developing alternatives. The first two of these imperatives can be seen as buying us time to achieve the more fundamental benefits of a diversified portfolio of transportation fuels. We must seek to widen the gap between available supply and demand in the short- to medium-term as a means of calming today's extremely volatile markets and putting downward pressure on prices, even as we begin developing clean and affordable alternatives for the long-term. The Commission's specific recommendations for widening the gap on the supply side include:

1. expanding and diversifying conventional supplies of oil, both at home and abroad;
2. expanding the global network of strategic petroleum reserves; and
3. exploring technologies and processes that would allow for the use of unconventional oil resources in a manner that is compatible with climate change and other environmental concerns.

On the demand side, the Commission recommends:

1. significantly strengthening fuel economy standards for new passenger vehicles, while simultaneously reforming the existing CAFE program to reduce compliance costs and provide cost-certainty for manufacturers and consumers;
2. creating incentives to accelerate the market penetration of highly efficient hybrid vehicles while also helping the domestic auto industry re-tool to meet growing demand for these vehicles; and

3. exploiting opportunities to boost the efficiency of heavy-duty vehicles and to improve the fuel-economy performance of the existing light-duty vehicle fleet.

Finally, to develop long-term alternatives to petroleum, the Commission recommends a sustained and vigorous effort to spur public and private sector investment in the development and early deployment of domestically-produced transportation fuels derived from biomass and organic wastes. Of all available alternatives to petroleum fuels, the Commission believes that cellulosic ethanol holds the most potential for displacing a significant fraction of transportation oil demand within the next 20–30 years and should therefore be a focus of near-term RD&D activities.

A summary of the potential benefits of supply & demand measures can be found at Appendix A.

Oil Supply Measures

The Commission believes that opportunities exist to substantially boost global oil production within the next ten to twenty years. This would help to relieve upward price pressures and reduce the risk of significant supply disruptions over the same timeframe.

Domestic Production: The United States is currently the third largest oil-producing nation after Saudi Arabia and Russia. As such, U.S. production clearly has a significant impact on the stability of the global oil market and efforts to expand production within our own borders must be pursued. Currently, the United States produces about 8.5 million barrels per day of oil (crude and products) and consumes about 21 million barrels per day of finished oil products. Domestic oil production is important to the nation's economy—it remains an important source of jobs and tax revenues in some regions of the country—and it offers the important advantage of reducing financial transfers to foreign nations. Although domestic production has generally declined over the past decade, it is now projected to increase modestly in the near term (1 million barrels per day in 2016) and to resume a gradual decline thereafter.

The United States is thought to have about 25 billion barrels of proved, conventional oil reserves, the great majority in Alaska and off our Pacific Coast with a smaller fraction off the Atlantic Coast and the eastern Gulf of Mexico.

CONVENTIONAL RESERVES	CRUDE OIL (billions of barrels)
Alaska (ANWR)	10.36
Pacific Offshore	10.71
Eastern Gulf of Mexico	3.58
Atlantic Offshore	2.31

Though technically recoverable, much of this oil is currently off-limits to leasing. If all of it were tapped, it is estimated that U.S. oil output could be increased by about 2 million barrels per day in 2020. Obviously, many issues must be considered in weighing whether it is appropriate to open a particular area to oil drilling and the Commission takes no position on whether the status of specific regions that are currently off-limits should be changed. To provide a sound basis for future decision-making, however, the Commission does believe that an inventory of domestic petroleum reserves should be

undertaken as part of a regular, comprehensive assessment of the nation's known and potential energy resources. Again, however, it cannot be stressed often enough that while U.S. production makes an important contribution to global supplies (and hence is critical to maintaining the near-term stability of global markets), our nation's economic vulnerability to oil price shocks is largely a function of how much oil we use and not how much we produce.

Global Production: Much more substantial oil reserves exist, of course, in other parts of the world, including—besides the Middle East—parts of the former Soviet Union, Africa, and South and Central America. The Commission therefore recommends that the U.S. government encourage nations with significant underdeveloped oil reserves to allow foreign investment in their energy sectors to increase global oil production. Kazakhstan, for example, provides an example of the benefits of liberalized investment policies. Having opened its oil resources to significant foreign investment in the mid-1990s, Kazakhstan's crude oil production rate more than doubled between 1996 and 2002. (See Fig. 3) Output from this one nation is now expected to reach 2 million barrels per day in the next few years and could peak at as much as 4 million barrels per day further down the road. The Commission also recommends that the U.S. government consider impacts on world oil markets in cases where unilateral economic sanctions imposed by our nation may be limiting investment in foreign energy markets without necessarily achieving their stated policy objectives.

Unconventional Oil Supplies: Accounting for unconventional oil supplies—such as tar sands in Canada, heavy oil in Venezuela, and oil shale in the United States—would significantly shift the hemispheric balance of world petroleum resources. (See Fig. 4) With today's high prices, these unconventional resources are already being tapped to a greater extent and by 2015 it is likely that Canada and Venezuela together will produce nearly 3.5 million barrels per dayD of unconventional crude. At the same time, the Fischer-Tropf process, which has been used for over 50 years to convert coal into a form of clean diesel fuel, could—at prices above $50 per barrel— become a significant source of domestic transportation fuel.

Further reliance on unconventional oil resources in the future, however, will require substantial progress toward reducing the substantial energy requirements and negative environmental impacts currently associated with extracting and processing them. Absent efforts to sequester the carbon used in producing unconventional oil, for example, the total greenhouse gas emissions associated with these resources are roughly two and a half times greater than the emissions associated with conventional oil production. While the Commission does not believe that our nation's oil policy must be viewed as a vehicle for achieving its climate protection objectives, it seems equally clear to us that it would be foolhardy to pursue an oil policy that is at odds with other compelling public policy objectives. Unless and until we learn how to develop these resources without significantly increasing greenhouse gas emissions, the Commission believes that exploiting unconventional oil reserves does not offer a viable long-term pathway toward a more secure energy future. Therefore, the Commission has recommended increased funding to improve the environmental performance of technologies and practices used to produce unconventional oil resources.

Strategic Reserves - Oil stockpiles provide an important insurance policy against the potentially dire consequences of a significant short-term global supply disruption. Combined with private stocks, the U.S. Strategic Petroleum Reserve currently provides us with enough spare capacity to cover the loss of all imports for approximately 150 days, or a partial disruption for much longer. To improve global and domestic oil security, the Commission recommends that the U.S. government work with other major oil-consuming nations to increase their public reserves and participate in the global network of strategic reserves.

In particular, membership in the International Energy Agency (IEA) could provide major emerging oil-consuming nations like China and India with: (1) a greater feeling of ownership on their part in how the "global energy system" is run, (2) improved transparency in energy statistics and policymaking, and (3) an established forum to communicate concerns, success stories, and partnership ideas. IEA membership also brings with it a requirement that nations maintain strategic oil stocks sufficient to supply 90 days of demand and agree to manage them in coordination with IEA member countries (although this requirement is not legally binding). Because the IEA is a cooperative group of the Organization for Economic Cooperation and Development (OECD)—the IEA's 26 member nations include most OECD countries—a number of issues would have to be addressed with respect to the inclusion of currently non-OECD developing nations. In the past, initiation into the OECD has been a lengthy and sometimes controversial process in which standards of economic development, openness, and human rights are considered. Given the potential benefits noted above, however, possibilities for bringing countries like China or India into the IEA on an expedited or alternative basis—perhaps with special observer or some other unique status—should be explored.

Oil Demand Measures

While the Commission firmly believes that both supply and demand measures must be pursued as part of an effective strategy to enhance the nation's energy security, it is important to emphasize that when it comes to protecting the economy from oil price shocks, a barrel produced and a barrel conserved are not the same thing. The benefits of every added barrel of supply—whether produced domestically or abroad—accrue to oil consumers the world over, in the form of a marginal reduction in the market price. By contrast, the benefits that can be achieved through demand-side measures and alternative fuel production—besides being much larger in absolute magnitude—are largely captured by those who implement them. The Commission therefore devoted significant attention to the potential for reducing our nation's oil demand, particularly in the transportation sector, which—because it accounts for nearly 70 percent of current domestic consumption and is nearly solely dependent on petroleum fuels—is key to oil use in the broader U.S. economy.

Strengthening and Reforming CAFE While Promoting Advanced-Technology Vehicles and Addressing Jobs and Competitiveness Concerns: Improving passenger vehicle fuel economy is by far the most significant and reliable oil demand reduction measure available to U.S. policy makers. As noted previously, CAFE standards played an important role in substantially reducing the oil intensity of the U.S. economy between the

late 1970s and early 1990s. However, a long-standing political stalemate has blocked significant progress in fuel economy for over two decades. (See Fig. 5) People often confuse our failure to increase domestic fuel economy with the view that technology options for improving vehicle efficiency have not advanced over the past two decades. Nothing could be farther from the truth. The efficiency of our automobiles increases annually. Estimates of this annual increase vary substantially from a low estimate of roughly 1.5% per year to a high estimate of over 5% per year. However, absent any requirement to direct these substantial efficiency gains toward achieving the public good of reduced oil dependence, vehicle manufacturers have instead devoted recent technological advancements to simply maintaining fuel economy while dramatically increasing vehicle size and power. While vehicle fuel economy is now no higher than it was in 1981, vehicle weight has increased by 24 percent and horsepower has increased by over 100 percent over this same time period. In fact, most of today's economy cars outperform the "muscle" cars of the 1970's. If we enhance the rate of efficiency advancement and channel the majority of this improvement into greater fuel economy, we can maintain the amenities of the current vehicle fleet while gradually increasing fuel economy every year.

In proposing to significantly strengthen and reform vehicle fuel economy requirements, the Commission sought to address the three issues we believe are most responsible for the last two decades of stagnation in this critical policy area: (1) uncertainty over the cost of future fuel-saving technology; (2) concern that more stringent standards will compromise vehicle safety; and (3) fears that new standards will put the U.S. auto industry and U.S. auto workers at further competitive risk relative to foreign automakers.

CAFE Reform: Pairing a significant increase in standards with reforms that would make the CAFE program more flexible and reduce the compliance burden for manufacturers would help to address cost concerns. The Commission commends recent efforts by the National Highway Traffic Safety Administration (NHTSA) to introduce program reforms as part of its 2005 rulemaking to update CAFE standards for light trucks. Further reforms that should be considered include allowing manufacturers to trade fuel economy credits with each other and across the light truck and passenger vehicle fleets, as well as "safety valve" mechanisms that would set a defined upper limit on compliance costs in the event that fuel-savings do not mature as expected or prove more expensive than anticipated.

The adequacy of NHTSA's authority to craft effective CAFE standards for passenger cars has recently been called into question. The Commission believes that NHTSA should be granted the requested authority and similarly that Congress should provide NHTSA with clear direction about how to apply it. When NHTSA sets new standards, the Agency seeks to fully offset the costs of new fuel-saving technology with the value of saved gasoline. This approach has obvious merit, but its application depends significantly upon NHTSA's ability to assess the full societal benefits of avoiding a gallon of gasoline consumption. At present, NHTSA lacks both the tools and authority to adequately factor in many of these broader externalities. This inability results in a systematic undervaluation of the benefits achievable through improved vehicle fuel economy and results in standards that are lower than would be justified by a more comprehensive assessment. It's not that NHTSA doesn't work hard to assess these externalities—in its recent light truck rulemaking, the Agency sought to include factors such as reduced

vulnerability to oil price shocks, reduced air pollution, and even the value of spending less time at gas stations.

However, NHTSA has no ability to quantify the value of reduced future tensions with China over tight oil supplies or the constraints that oil dependence imposes on our foreign policy. After considering the costs of protecting our access to global oil resources, NHTSA, in its recent rulemaking, decided not to include any value in reduced military costs as a result of increased fuel economy. The Regulatory Impacts Assessment reads:

> "The U.S. military presence in world regions that represent vital sources of oil imports also serves a range of security and foreign policy objectives that is considerably broader than simply protecting oil supplies. As a consequence, no savings in government outlays for maintaining the Strategic Petroleum Reserve or a U.S. military presence are included among the benefits of the light truck CAFE standard adopted for MY 2008 - 2011."

All told, NHTSA's recent rulemaking assesses total petroleum market externalities to be slightly less than six cents per gallon. When added to projected gasoline costs of $1.60 per gallon over the next decade ($2 pump price minus roughly $.40 in taxes), NHTSA arrives at a total societal value of a gallon of gasoline saved at just under $1.70 gallon. This number clearly helps explain why the increase in truck standards that emerged from the rulemaking process was so modest.

When considering the Administration's recent request that Congress grant NHTSA broad authority to reform passenger car standards along the same lines as the recent light-truck rulemaking, Congress must also consider giving the agency specific, updated guidance about the factors to be considered in establishing standards and about how these factors should be weighted and analyzed. Moreover, given the apparent political difficulty of revisiting fuel economy regulations, Congress should also consider establishing—or directing NHTSA to establish—a dynamic fuel economy target that becomes gradually but steadily more aggressive over time, rather than picking a single number. A defined percent-per-year improvement goal, coupled with an effective cost-capping mechanism or well-defined "off-ramps" in the event that later requirements begin to impose unacceptable trade-offs in terms of cost or other vehicle attributes, may prove more effective over time and more palatable in the short run, than choosing a particular mpg requirement that remains fixed for years or even decades.

Vehicle Safety: Safety concerns have long contributed to the prevailing CAFE stalemate, but there is reason for optimism that the terms of this debate too have begun to shift in important ways. First, the rapid emergence of hybrid-electric vehicle technology clearly demonstrates that substantial fuel economy improvements can be achieved while maintaining or even increasing horsepower and without reductions in vehicle weight or size. Second, a more sophisticated approach to the issue of safety—one that accounts for the impact of heavier vehicles on other vehicles in the event of a collision and their effects on overall fleet safety as well as on the safety of their individual occupants—has served to illuminate the fact that while the relationship between vehicle weight and safety is clearly important, it is far from straightforward. Finally, some argue that advances in light but very strong composite materials that allow for significant weight reductions to

be achieved in concert with ongoing safety improvements—together with other advances in vehicle design and safety features—will prove fundamentally game-changing, although for now cost issues remain.

Domestic Industry Competitiveness: Given the recent, well-publicized troubles of U.S. automakers, concerns about jobs and competitiveness will continue to figure prominently in any debate over vehicle fuel economy. The Commission worked with the United Auto Workers and experts at the University of Michigan to assess the competitive impacts of a significant increase in fuel-economy requirements on the domestic automobile industry. Our analysis suggests that the domestic automakers currently are at a disadvantage, relative to their foreign competitors, in terms of the expertise and manufacturing capacity needed to design, produce, and incorporate the most advanced hybrid-electric and diesel technologies. Therefore the Commission urges policymakers to consider mechanisms for addressing jobs and competitiveness concerns that would strengthen the domestic industry and better position it to meet future global demand for advanced technology vehicles. Specifically, the Commission recommended in its 2004 report that consumer tax incentives to stimulate consumer demand for highly efficient, advanced-technology vehicles be extended and coupled with business tax incentives aimed at helping parts suppliers and manufacturers with U.S. facilities retool their plants to produce these vehicles. Importantly, the Commission's analysis showed that such incentives could be designed to ensure that their cost to the U.S. Treasury would be more than covered by the additional tax revenues associated with increased domestic production. In light of the fact that domestic manufacturers are presently losing money and hence not paying much in the way of taxes, additional work is underway to design alternative mechanisms to provide the suggested incentives.

Oil Savings through Increased Fuel Economy: The oil savings achievable through improved new vehicle fuel economy depend, of course, on specific assumptions about how quickly and aggressively new standards would be introduced and on whether other aspects of the current CAFE program are reformed at the same time. Appendix A summarizes the results of a bounding exercise intended to portray the savings that could be achieved if new vehicles technologies were employed to increase fuel economy over the next twenty years. The results are cumulative (that is, each row includes the demand reductions associated with all of the rows above it) and reflect oil savings in 2025 from a baseline business-as-usual demand forecast of 26 million barrels per day. The table suggests that the United States could reduce oil consumption in 2025 by 2.2 million barrels per day by implementing a 40 percent improvement in gasoline vehicle efficiency. If a significant fraction of fuel-efficient hybrid vehicles were added to the mix, the savings would rise to roughly 3.5 million barrels per day. Under the most aggressive scenario considered, U.S. oil consumption could be reduced by nearly 5 million barrels per day if the new-vehicle fleet in 2025 were comprised of a combination of efficient gasoline, gasoline hybrid and plug in hybrid vehicles.

Fuel Economy Improvements in the Heavy-Duty Truck Fleet and Existing Light Vehicle Fleet: Smaller but nonetheless important opportunities exist to reduce U.S. oil consumption by improving the fuel economy of the heavy-duty truck fleet and of the existing light-car fleet. The Department of Energy's 21st Century Truck Program, for example, is being undertaken with the cooperation of major heavy-truck engine

manufactures; it estimates that the fuel economy performance of so-called "Class 8" long-haul trucks, which are the largest fuel consumers of all heavy trucks, could be improved as much as 60 percent. Enhanced diesel technology and improved aerodynamics in the heavy-duty truck fleet could produce oil savings of as much as 1 million barrels per day in 2025. As an initial step, the Commission recommends that EPA be instructed to develop a test procedure to assess heavy-duty vehicle fuel economy so that we have an opportunity to seek reductions from this sector should the will to do so emerge in the future. For the existing light-duty vehicle fleet, simply ensuring that replacement tires have the same low rolling resistance as original-equipment tires can improve vehicle fuel economy by as much as 4.5 percent at very low cost to the vehicle owner.

Efficiency improvements are important not only because they produce demand reductions that will allow us to "buy time" to develop new alternatives to oil (a serious effort to diversify our fuel supply will likely take decades), but because they are essential to making many of those alternatives technologically and economically viable on a commercial scale. Biofuels and most other alternative fuels suffer from feedstock constraints, a lower energy density than gasoline, or both. Unless the vehicle fleet becomes more fuel-efficient, efforts to promote a greater reliance on alternative fuels will likely falter due to inadequate supply or inadequate driving range. Conversely, the land requirements for cellulosic ethanol production or the battery requirements for a plug-in hybrid-electric vehicle become much more manageable if the vehicles that employ these fuels or technologies are also highly efficient to begin with. Once one recognizes that the successful development of petroleum alternatives depends on highly efficient vehicle technologies, it becomes apparent that current provisions intended to promote the production of flexible-fueled vehicles by providing credits that weaken overall fleet fuel economy are shortsighted and ultimately counterproductive.

Developing Alternatives to Oil

The United States burns nearly 140 billion gallons of gasoline each year and relies on petroleum-based fuels to supply nearly all of its transportation energy needs. To meaningfully improve our nation's energy security, alternative transportation fuels must be capable of being economically and reliably produced on a truly massive scale. The Commission identified four criteria that characterize a promising alternative fuel: (1) it can be produced from ample domestic feedstocks; (2) it has low net, full fuel-cycle carbon emissions; (3) it can work in existing vehicles and with existing infrastructure and (4) it has the potential to become cost-competitive with petroleum fuels given sufficient time and resources dedicated to technology development. Among the variety of alternative fuel options potentially available for the light-duty vehicle fleet, the Commission believes that ethanol produced from cellulosic biomass (i.e. fibrous or woody plant materials) should be the focus of near-term federal research, development, and commercial deployment efforts. Let me briefly discuss the attributes of traditional corn-based ethanol and then turn to cellulosic ethanol.

Corn-based ethanol is far and away our most successful non-petroleum transportation fuel. The Renewable Fuels Standard adopted in the 2005 Energy Policy Act imposes an annual ethanol sales requirement that grows to 7.5 billion gallons in 2012. Ethanol sales were roughly 4 billion gallons last year. Despite the beneficial sales-volume credits

given to producers of cellulosic ethanol, virtually all of this mandate will be met with traditional corn ethanol. A requirement to sell 250 million gallons of cellulosic ethanol takes effect in 2013. To an extent, Congress's effort to stimulate demand for cellulosic ethanol may be undermined by the unexpected demand for ethanol of any kind. Present expectations are that demand for ethanol will exceed the requirements of the RFS for most if not all of the program. In this context, credits may have little or no value and the 2.5:1 cellulosic credit advantage may provide no meaningful benefit. Congress may want to investigate other policy approaches to achieve the intended aims of these credit provisions.

For years, detractors of corn-based ethanol have asserted that the energy content of a gallon of ethanol is matched or even exceeded by the energy required to produce it. The Commission's analysis disputes this conclusion, finding that corn-based ethanol provides nearly 20 percent more energy than it takes to produce. A more recent study by Argonne National Laboratory finds nearly a 35 percent benefit. Nevertheless, the fundamental liability of corn-based ethanol is that there is simply not enough corn to begin to keep pace with expected growth in transportation energy demand, let alone to reduce current U.S. gasoline consumption in absolute terms. Put simply, it takes roughly 4 percent of our nation's corn supply to displace 1 percent of our gasoline supply. Even organizations devoted to ethanol advocacy agree that it will be difficult to produce more than 10–12 billion gallons of ethanol a year without imposing unacceptable demands on corn supply and significant upward pressure on livestock feed prices.

Cellulosic ethanol is chemically identical to corn-based ethanol and is equally compatible with existing vehicle technology and fueling infrastructure. The added advantages of cellulosic ethanol lie in its significantly lower energy inputs and greenhouse gas emissions, its much larger base of potential feedstocks, and its greater potential to become cost-competitive with gasoline at very large production volumes. For cellulosic ethanol to succeed on a commercial scale, however, important concerns about land requirements must be overcome and production costs must be reduced. The central challenge is producing enough feedstocks without disrupting current production of food and forest products. Some cellulosic ethanol can be produced from currently available waste products such as corn stalks, sugar cane bagasse, and wheat straw. Production volumes on the order of 50 billion gallons per year, however, will require improved high-yield energy crops like switchgrass, the integration of cellulosic ethanol production into existing farming activities, and efficiency improvements in the processes used to convert cellulosic materials into ethanol.

A Commission-sponsored analysis of the land required to produce enough cellulosic ethanol to fuel half of the current U.S. passenger vehicle fleet reveals the importance of the advancements noted above. Using status quo assumptions for crop yields, conversion efficiency, and vehicle fuel economy, Oak Ridge National Laboratory has estimated that it would take 180 million acres or roughly 40 percent of the land already in cultivation in the U.S. to fuel half the current vehicle fleet with cellulosic ethanol. Estimated land requirements can be reduced dramatically—to approximately 30 million acres—if one assumes steady but unremarkable progress over the next two to three decades to (1) double per-acre yields of switchgrass, (2) increase the conversion efficiency of ethanol production by one-third, and (3) double the fuel economy of our vehicle fleet. As a point

of reference, there are roughly 30 million acres in the Conservation Reserve Program (CRP).

Another central challenge is reducing production costs for cellulosic ethanol. Because energy crops like switchgrass can be grown with minimal inputs of energy, fertilizer, and pesticides, the use of such feedstocks offers obvious economic benefits, as does producing ethanol from materials that would otherwise be treated as waste. The National Renewable Energy Laboratory and a separate analysis sponsored by the Commission both suggest that mature cellulosic ethanol production could compete economically with gasoline. However, these studies are projections. At this time, no full-scale production of cellulosic ethanol exists anywhere in the world. Until cellulosic ethanol is produced in a variety of commercial facilities, it will not be possible to prove or disprove current cost estimates. These are serious challenges, but they are achievable if we dedicate ourselves to a serious, coordinated, and sustained research, development, and commercialization effort.

As a critical first step in this direction, the Energy Policy Act of 2005 contains at least ten major programs to promote ethanol derived from cellulosic feedstocks. These programs include explicit authorizations for more than $4.2 billion over the next decade to support critical R&D as well as "first-mover" commercial facilities through a combination of grants, loan guarantees and production incentives. While these programs demonstrate Congress's clear intention to promote biofuels, continued vigilance will be required to ensure that this vision is achieved. Historically, efforts to promote biofuels have been undermined by a lack of appropriations, inconsistent funding year to year, and an unusual degree of Congressional earmarks. These factors, if continued, will make it difficult to achieve the critical objective of diversifying our nation's fuel supply.

The 2005 Energy Policy Act also took steps to ensure that increased use of ethanol will not undermine air quality and public health standards. Eliminating the opportunity for ethanol-blended gasoline to meet less protective evaporative emission standards remains necessary to ensure that our efforts to increase energy security do not undermine our clean air goals. Finally, car makers will need to take some steps to better accommodate ethanol-blended gasoline. The Coordinated Research Council, which is supported by the automotive and petroleum industries and the State of California, has been conducting research to examine the extent to which automobile evaporative emissions increase in cars using ethanol-blended fuels. The research appears to indicate that when a small quantity of ethanol is blended into gasoline, the resulting mixture escapes more readily through the hoses and seals in the vehicle's fuel system leading to more smog-forming emissions. The problem appears less prevalent in newer vehicles but demonstrates the type of challenges that will arise as we begin to transition toward a more diverse suite of transportation fuels. One of the many reasons for interest in promoting flexible-fueled vehicles capable of running on up to 85 percent ethanol blends is that when ethanol is the dominant constituent, the overall volatility of the fuel is reduced and evaporative problems go away. Efforts by Chairman Lugar, Senator Obama, and others to increase the number of flexible-fueled vehicles sold over the next decade and significantly increase ethanol refueling infrastructure deserve serious consideration.

In sum, the Commission urges Congress to make every effort to fund the research and demonstration projects authorized in the Energy Policy Act of 2005. While it is clear that all discretionary programs must come under continual budget scrutiny, inconsistent funding from year to year can be devastating to long-term research efforts by making it impossible to hire and train experts, build infrastructure, and amass knowledge based on iterative experimentation. The Commission recognizes that Congress alone is responsible for appropriations, but can't help but note that the high level of non-competitive earmarks is undermining the strategic goals of our nation's bioenergy programs. For example, in 2004, of the $94 million in appropriations for DOE's bioenergy programs, nearly $41 million was directed to earmarked projects. In 2005, earmarks accounted for nearly 50 percent of the program's budget. Paradoxically, this high level of earmarks reflects the enthusiasm of many members of Congress for promoting domestic alternatives to petroleum. However, an effective national effort that coordinates the efforts of federal state and private institutions cannot be mounted under these circumstances.

Conclusion

Sadly, there are no good options for delivering immediate relief from high prices at the gas pump. And while it's understandable at times like this that people want to focus on price gouging, windfall-profits, or restrictive environmental laws—as if our plight was somehow the result of a few greedy people or poorly written statutes—we must direct the vast majority of our attention to confronting the fundamental roots of our oil security predicament. To make real progress, we must substitute thoughtful analysis for rhetoric and rise above the temptation to take political advantage of the current crisis by crafting a truly bipartisan response.

Prices may, of course, fall again in the months ahead. But there is almost no scenario in which the underlying causes of the current crisis simply resolve themselves without a concerted effort by the United States and other major oil-consuming nations to change course. The real tragedy would be if this "moment" simply passes as others have with no real progress toward a lasting solution. In short, there is no question that we will someday use less oil than we do now. The question is rather whether we arrive at that point on our own terms or on someone else's. The Commission believes that the sacrifices we choose are infinitely preferable to those imposed on us by forces we cannot control. The National Commission on Energy Policy looks forward to working with this Committee in its ongoing effort to chart a more secure energy future for our nation

Appendix A

Summary of Measures for Improving U.S. Oil Supply

Increasing Supply	**Measure**	**Projected Impact**
	Exploit all domestic conventional reserves	Increase US output by 2.0 MBD
	Exploit global reserves of unconventional oil	Increase global supply by 4.0+ MBD

Reducing Demand	**Measure**	**Projected Oil Savings**
	Heavy Duty Trucks	
	Enhanced Diesel Technology and Aerodynamics	1.0 MBD
	Reduce Average Highway Speed by 10 mph	0.3 MBD
	Passenger Vehicles and Delivery Trucks	
	Advanced Gasoline Engine Technology (32 mpg)	2.2 MBD
	Advance Gasoline Engine Technology + 50% Advanced Hybrid/Diesel Sales (40 mpg)	3.5 MBD
	Advanced Gasoline Engine Technology + Advanced Hybrid/Diesel + 25% Plug-in Hybrids (50 mpg)	4.6 MBD

Developing Alternative Fuels	**Measure**	**Projected Oil Savings**
	Quadruple ethanol production post-2012	2.0 MBD (30 billion gallons)
	Dramatically increase biodiesel production	0.5 – 1.0 MBD (7.5 – 15 billion gallons)
	Create Domestic Fischer-Tropsch Industry (Coal to Diesel)	0.5 – 3.0+ MBD (7.5 – 45+ billion gallons)

Figure 1

World Oil Demand Forecast

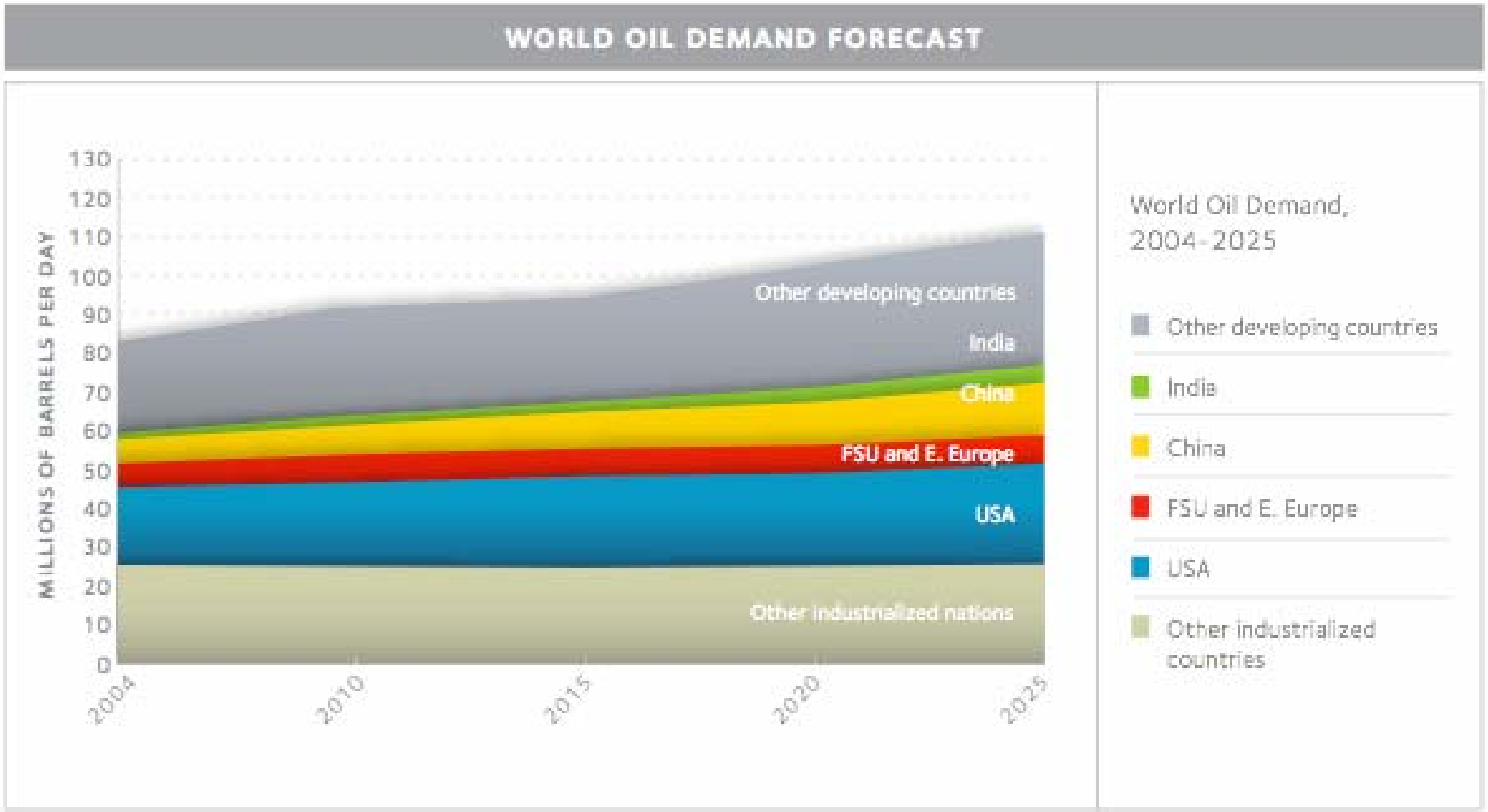


Figure 2

Oil Intensity 1970 -2000

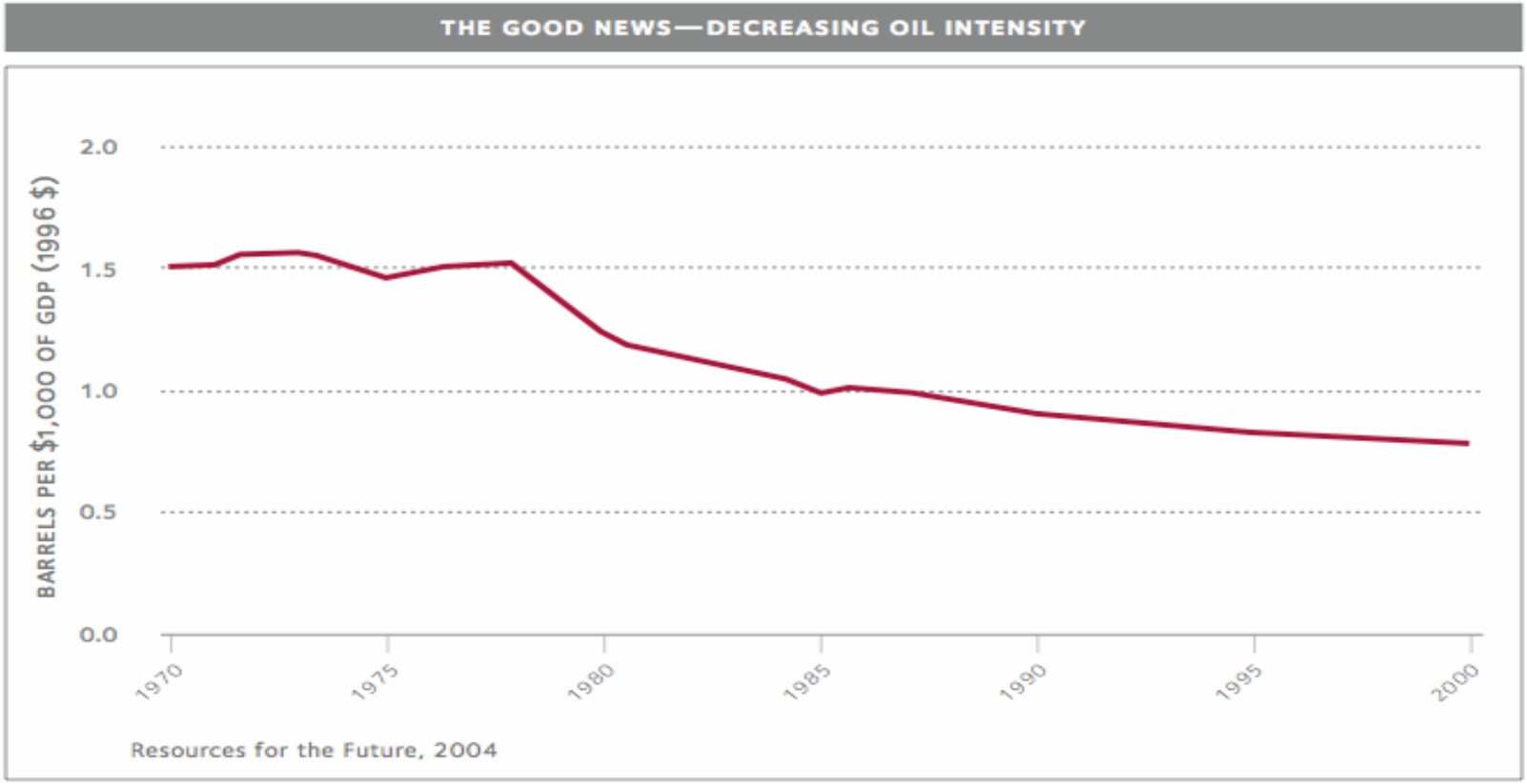
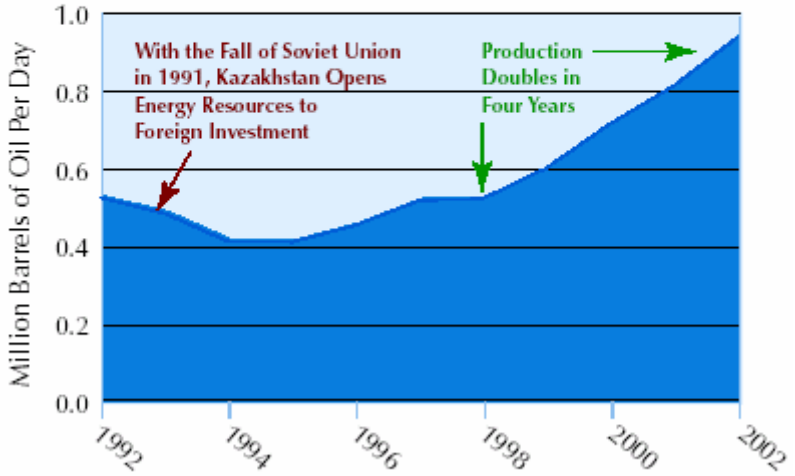


Figure 3

Impact of Foreign Investment on Oil Production

Kazakhstan opened its energy resources to foreign investment in the early 1990s and witnessed a rapid increase in oil production over the next decade.



Data Source: Energy Information Administration, 2004

Figure 4

Unconventional Oil

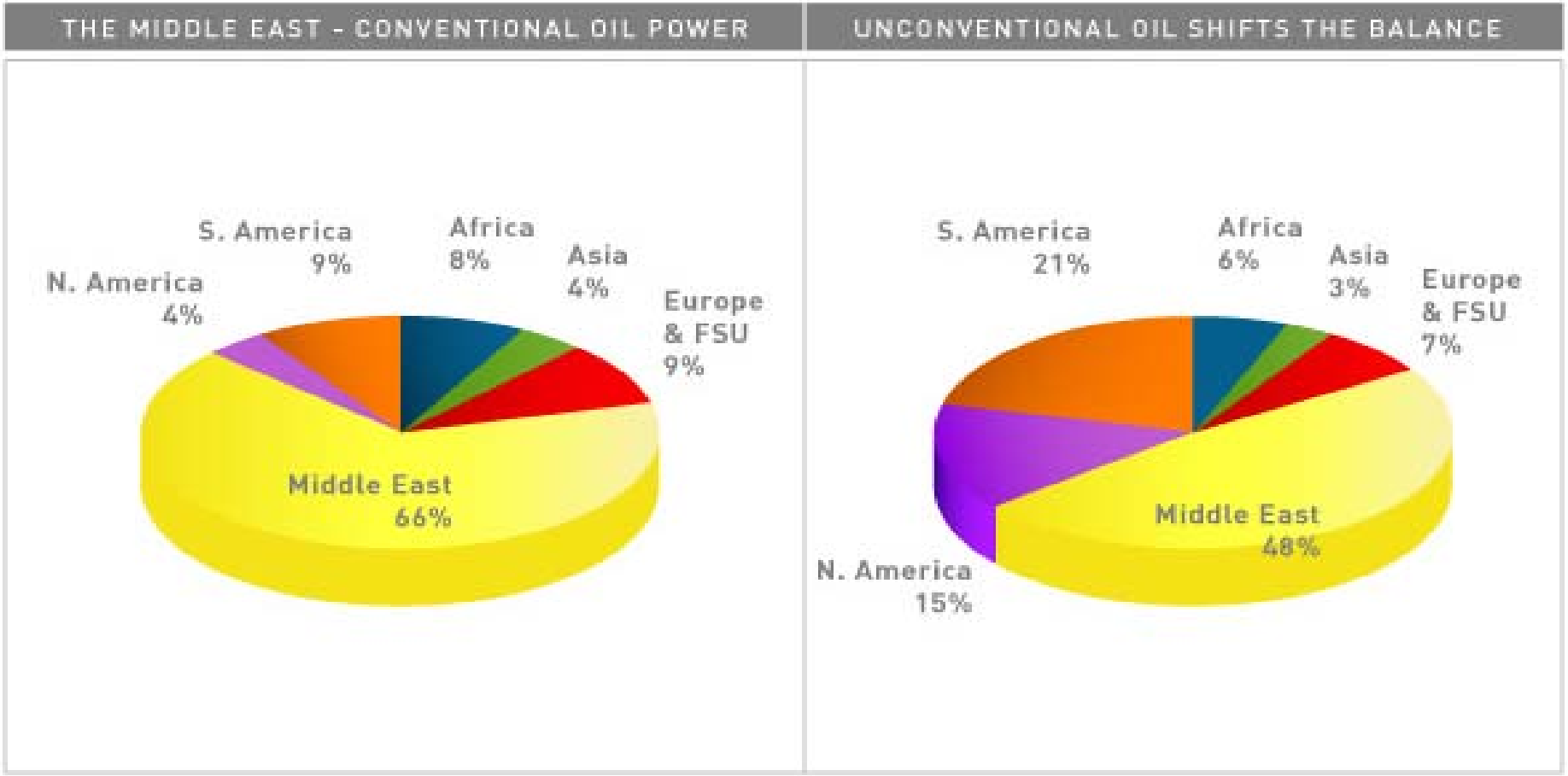
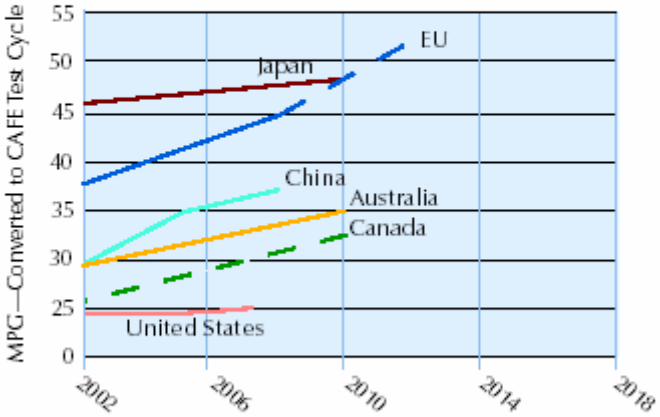


Figure 5

Comparison of Projected Fuel Economy Levels

The fuel economy of the U.S. automobile fleet—both historically and projected based on current policies—lags behind most other nations.[29]



* Dashed lines represent proposed standards

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