A High Growth Strategy for Ethanol

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Introduction

The United States depends on foreign sources for almost 60 percent of its oil supply, double the level of imports in 1972, the year before the Arab OPEC oil embargo. While enabling inexpensive transportation that has contributed to the nation's robust economic growth, this increasing reliance on oil is a costly bargain: high and volatile oil prices threaten our economy, our addiction to oil hamstrings our foreign policy and puts petrodollars in the pockets of terrorists and hostile regimes, and, like all fossil fuels, burning oil contributes to the degradation of our air, water, and climate.

Recent increases in the price of oil, driven by growing demand, especially from China, and by political risk in the Persian Gulf and other oil-producing areas, are harbingers of the rising economic threat. The Energy Information Administration in 2006 increased its 20-year price forecast for oil by roughly $20 a barrel from the year before, or about two-thirds. In the EIA reference case, the future price of imported crude never falls below $43 a barrel.

Two-thirds of U.S. oil consumption is for transportation, and two-thirds of that is for cars and light trucks. To reduce our dependence on oil, therefore, aggressive steps must be taken to reduce consumption of gasoline. A program reflecting national commitment and leadership is needed. Toward that end, we recommend that the

U.S. adopt a very ambitious goal of producing 100 billion gallons per year of ethanol by 2025, the equivalent of half of today's U.S. gasoline consumption or nearly 25 percent of today's overall U.S. oil use.

Ethanol can be used in existing cars in blends of 10 percent with gasoline. Flexible-fuel vehicles, capable of using either ethanol or gasoline, interchangeably, offer consumers the option of using blends of up to 85 percent ethanol. Conventional sources of ethanol, principally corn starch, are believed capable of producing 15-20 percent of the 100 billion gallons in our goal. The balance would have to come from cellulose, the fibrous material found in all plants, including non-food crops like switchgrass and wood chips. Advanced technology for converting cellulose to ethanol is currently being commercialized.

Our goal is substantially higher than many projections and assumes the adoption of most or all of the recommendations at the end of this report. The following steps are needed to achieve the goal and should be undertaken in parallel:

- We must greatly expand the total supply of feedstock available for ethanol production, largely through feasible improvements in yields per acre and the use of some Conservation Reserve Program land for energy crops.

- The conversion technology and refineries to process cellulosic biomass to ethanol must be developed, financed and built, and yields of ethanol per ton of biomass must increase.

- The number of vehicles capable of using high blends of ethanol and the number of service stations distributing such blends must be increased.

- Investors and developers in the nascent ethanol industry, as well as to gas station owners and auto manufacturers, must be assured that we are committed to a sustained effort to reduce our dependence on oil even in the face of a potential effort to drive down oil prices.

- The public needs to be better informed about the benefits of ethanol as a major portion of our transportation fuel mix.

Challenges and Opportunities

Security

Each of the oil crises of the last 35 years (triggered by the Arab OPEC oil embargo in 1973, the Iranian revolution in 1979, and the Iraqi invasion of Kuwait in 1990) caused significant economic harm to the U.S. and resulted in calls for reduced dependence on imported oil. Yet despite some fuel switching and improvements in efficiency, U.S. oil imports have increased from about 30% in 1972 to almost 60% in 2005. U.S. consumption continues to grow, while domestic production has declined steadily since 1970. World demand is expected to grow from today's roughly 85 million barrels per day to nearly 120 million barrels per day in 2025, and some analysts argue that most readily accessible conventional oil reserves have been discovered and production is about to peak.

Even before the 9/11 attacks and the war in Iraq, increasing U.S. and world dependence on oil from the volatile Middle East constrained our foreign policy options. As U.S. oil imports increase, global demand accelerates, and reserves outside the Persian Gulf region decline, the security risks of our oil addiction will grow. A transition to using ethanol in our cars, however, along with improved fuel economy and other alternatives, will help reduce U.S. dependence on oil and thereby decrease our vulnerability to oil price shocks and increase our foreign policy options, particularly if other nations follow suit.

Environment

There is widespread agreement among scientists that human emissions of carbon dioxide and other greenhouse gases are likely to have serious consequences for the world's climate. To prevent dangerous interference with the climate system, global carbon emissions over the next 50 years will need to be reduced by about 175 billion tons compared

to a business-as-usual scenario. This will require a variety of actions in the U.S. and worldwide. More than 25 percent of manmade emissions of CO_2 in the U.S. are from transportation, and reducing the use of gasoline in cars is one of the largest contributions we can make. Compared to gasoline, ethanol made from corn is estimated to reduce greenhouse gas emissions by 20-30 percent and ethanol from cellulose – made from the stalks, stems and leaves of plants – by about 85 percent or more.

Using renewable fuels in transportation can also help reduce the air pollution associated with burning petroleum. With the adoption of sustainable production methods in the agricultural sector, the environmental impacts of farming practices can also be reduced.

Economy

Increasing global demand and a lack of spare production capacity, exacerbated by hurricane damage to U.S. production facilities and turmoil in some exporting countries, have contributed to recent high oil prices and threatened economic growth. Substituting domestically produced ethanol for a large portion of our gasoline use can dramatically reduce our oil imports and our balance of trade deficit. If oil averages $60 per barrel for 2006 and imports are over 12.5 million barrels per day, we will send about a quarter of a trillion dollars abroad for oil – nearly a third of last year's record trade deficit. Reducing our oil addiction can thus contribute to resolving some of our most difficult current economic problems as well as reduce our vulnerability to the economic devastation of future oil price shocks.

Substituting ethanol for gasoline can also begin to transform our system of agricultural price supports and land set-aside programs while creating jobs and stimulating the economy in rural areas. Transitioning some farm support programs toward assistance for energy crops would be more economically rational and would have significant energy and environmental benefits. World Trade Organization decisions declaring some current farm subsidies in violation of trade regulations may require that such a transition be initiated quickly. Reauthorization of basic agriculture programs, required in 2007, provides an opportunity.

Growing energy crops and harvesting agricultural residues will increase the value of farm output. Expanding the production of cellulosic biomass and adding it to increased production of corn will allow a substantial increase in ethanol production. The economic benefits will include additional and more diversified markets for both grain and energy crops that can help agriculture production achieve higher net returns, both locally and in the world economy. In addition to these benefits, investment in production plants located largely in rural areas will provide jobs and an increased tax base to help support local governments, schools and other public services. The benefits combined may even be able to slow the conversion of farmland into residential development and suburban sprawl.

The Potential of Ethanol

Biomass feedstocks for ethanol are abundant, varied and relatively inexpensive, and their potential for improved yields and processing potential are great. (See "Biotechnology for Biofuels Production," by Richard Hamilton, Appendix D.) With a concerted effort the U.S. can sustainably produce much more biomass for energy without diminishing our capacity to produce food. (See "Cellulosic Ethanol in an Oil and Carbon Constrained World," by W. Michael Griffin and Lester B. Lave, Appendix A, and "Impacts of Cellulosic Ethanol on the Farm Economy," by Bruce E. Dale, Appendix B.) With a corresponding effort, we can greatly reduce the cost of converting that biomass to ethanol, produce the cars to use it, and provide the fueling infrastructure. On average oil prices are projected to rise over time. Given sufficient development effort, ethanol can be expected to sell for less than gasoline, even taking into account ethanol's lower energy content per gallon.

Ethanol from corn and ethanol from cellulose are the same product. Ethanol in the U.S. is currently derived primarily from the starch in corn kernels. Ethanol from cellulose can be produced from a wide variety of feedstocks, including plants (switchgrass, sunflowers, hemp), plant waste (corn stover, cereal straws, sugarcane bagasse), and plant waste from industrial processes (sawdust, paper

pulp, wood chips). Many experts expect switchgrass, a hardy, fast-growing, perennial crop that can be grown in large parts of the U.S., to be one of the major feedstocks of a mature ethanol industry.

Ethanol from corn is an established industry with substantial additional growth potential. The Renewable Fuels Standard passed by Congress in the Energy Policy Act of 2005 (EPAct 2005) requires the integration of 7.5 billion gallons of ethanol per year into the gasoline supply by 2012. We cannot, however, reach the goal of 100 billion gallons without ethanol from cellulose and without improvements in energy crop yields and the development of appropriate biorefineries. (See "Commercialization of Cellulosic Ethanol Facilities: A Financial Perspective," by Richard (Roy) Torkelson, Appendix E.) Ethanol from cellulose can also increase the environmental and other benefits already derived from corn ethanol. (See "Ethanol and the Environment: Delivering on the Promise of a Sustainable Biofuel," by Nathanael Greene, Appendix C.)

All cars and light duty trucks in the U.S. can already run on E10, a blend of gasoline containing 10 percent ethanol. There are also over five million flexible-fuel vehicles (FFVs) on the road today capable of running interchangeably on gasoline, E85 (a mixture of 85 percent ethanol and 15 percent gasoline), or any blend in between. Relatively few service stations sell E85, however, and many vehicle owners do not know that their cars can use it.

The principal challenge of achieving ethanol's potential is to increase concurrently feedstock production, conversion capacity, and availability of FFVs and E85 pumps so that a delay in one does not strand investments in the others. A second set of challenges is to correct misperceptions and manage expectations related to ethanol. For instance, the widely held perception in the U.S. that more energy is used to grow, transport and process the feedstock into ethanol than is contained in the ethanol itself is simply wrong. A growing number of peer-reviewed studies show that corn ethanol contains significantly more energy than it takes to produce it. Ethanol from cellulose will provide even higher energy returns. (See "Impacts of Cellulosic Ethanol on the Farm Economy," by Bruce E. Dale, in this volume; "Ethanol Can Contribute

to Energy and Environmental Goals," Farrell et al, *Science*, January 27, 2006; and "Ethanol's Energy Return on Investment: A Survey of the Literature 1990-Present," by Roel Hammerschlag, *Environmental Science and Technology,* February 2006.) This misperception also reflects a misplaced concern, because producing and converting primary energy such as oil or coal into a usable product such as gasoline or electricity always requires large amounts of energy.

Similarly, we must manage the expectation that ethanol, or even ethanol from cellulose, is a silver bullet that can reduce gasoline prices overnight or single handedly solve all of our oil related challenges. It will be several years before we can start to produce a significant amount of ethanol from cellulose, so we must continue to grow the existing industry. Furthermore, improving the efficiency with which we use both gasoline and ethanol will always be the cleanest and fastest way for us to reduce our dependence on oil. In particular, improving the fuel economy of our cars and trucks is essential to managing the land requirements of ethanol.

The Brazilian Model

Brazil is on the verge of becoming independent of the need for oil imports due to its widespread use of flexible fuel vehicles and large-scale shift from gasoline to ethanol made from sugar cane. Although the U.S. and Brazilian situations differ in many respects – for example, ethanol produced from corn costs more and produces less energy per unit of input than ethanol from sugar cane – the speed of Brazil's adoption of flexible-fuel vehicles can be a model for the U.S. In the last three years, driven entirely by consumer demand, sales of flexible-fuel vehicles has gone from near zero to 75 percent of new cars. (See "Ethanol: Lessons from Brazil," by David Sandalow, Appendix F.) This shows the power of consumer demand when consumers are given a real choice.

We can also learn from Brazil's strategic mistake. Brazil launched a "Pro-Alcohol" program in the 1970s in response to the oil crisis. By the end of the 1980s, however, more than 75 percent of cars made in Brazil ran only on ethanol, leaving motorists in a lurch when oil

prices fell and sugar prices rose sharply. Brazilian filling stations now offer pure ethanol and a blend of gasoline and 20 percent ethanol called gasohol, and the growing number of motorists with flexible-fuel vehicles use them interchangeably depending on price. Even though the early experience ended badly, Brazilians were left with the understanding that ethanol is a viable alternative fuel and quickly reached a tipping point when offered flexible-fuel vehicles that give them the power to choose. While it is hard to know what availability of flexible-fuel vehicles and E85 pumps would be needed in the United States, Brazil shows us that once we pass that tipping point, consumer choice can transform the market very quickly.

Research and Development

New technology to produce ethanol from cellulosic feedstocks points the way to a new generation of ethanol plants. The production chain consists of feedstock production, feedstock pretreatment, enzymatic hydrolysis, and fermentation. To make ethanol from cellulose competitive with gasoline, research is needed to improve the efficiency and economics of each portion of this chain *and* to integrate the chain. Emphasis therefore must be placed on the need to reduce costs by a combination of focused research and process demonstration at scale.

On top of fully funding R&D, a good deal of which is already authorized, financial investment and large scale commercial plants are needed to convert switchgrass and other cellulosic biomass to ethanol. The financial investments and market confidence needed to construct and pilot-test commercially viable biorefineries probably presents the most challenging single impediment to the new industry. Government assistance, in the form of loan guarantees or tax incentives for the first commercial plants, is needed to expedite the development of cellulosic ethanol production.

Recommendations

As part of trying to achieve the goal of 100 billion gallons of ethanol by 2025, the participants endorsed a series of recommenda-

tions aimed at the necessary prerequisites: an expanded supply of feedstock, adequate biorefineries to convert the feedstock to ethanol, sufficient flexible-fuel vehicles and E85 pumps, protection against an oil price collapse during the industry's infancy, and public education on ethanol. Except as specified below, all participants concurred in the recommendations. They are numbered for convenient reference, not to indicate any order of priority.

1. **Significantly increase sustainable biomass supply for ethanol a) by fully funding existing legislative authorization for research and development to increase biomass yield per acre and b) by increasing the total number of acres on which biomass can be sustainably grown.**

   Authority exists in the Biomass Research and Development Act of 2000, as amended by the Energy Policy Act of 2005, to support biomass R&D. This program should be fully funded at the authorized level of $200 million per year. Yet even if fully funded, additional R&D will still be needed to speed up advances in yield and deployment of new crops, harvesting technologies, and biomass handling strategies. State and federal governments, working with the private sector, should review the R&D needed and provide the leadership and financial support to increase, in a sustainable way, the supply of biomass for ethanol production.

   The U.S. government should provide direct support to farmers with specific incentives such as government contracts and loan guarantees for increasing biomass acreage dedicated to energy crops for ethanol around new biorefineries. Acreage in the Conservation Reserve Program that can be utilized for biomass harvesting under the authorities and restrictions in the 2002 farm bill needs to be identified.

2. **Catalyze greatly expanded ethanol production by providing appropriate government incentives to farmers and ethanol producers.**

   To commercialize production of ethanol from cellulose, ade-

quate government incentives are needed both for the biorefineries and for the early production of dedicated energy crops to supply the biorefineries. This new ethanol-from-cellulose technology will require government support until such time as it is commercialized to a significant degree, perhaps 5-10 years. Dedicated energy crops may take several years to mature for harvest. Landowners and operators will need sufficient incentives to begin to grow and harvest these crops.

Building new ethanol plants or retrofitting existing ones to produce ethanol from cellulose will also require tax credits or loan guarantees initially. Public R&D investments will be needed along multiple technical pathways for pretreatment and conversion of cellulose.

3. **Institute measures to ensure that ecosystem integrity is maintained or enhanced with ongoing ethanol feedstock production.**

Wild places should be protected from pressures to harvest biomass for ethanol, and agricultural and forestry ecosystems that are used to produce biomass must be maintained or enhanced even as we work to greatly increase overall production. The key measure of ecosystem integrity in this context is probably soil organic matter, which affects the quality of air and water. Other important metrics include mineral nutrient flows, water use and animal habitat. Field research and modeling should address the wide variety of ecosystems from which biomass might be produced and provide biomass producers with practical guidelines for the maintenance or enhancement of ecosystem integrity.

The Department of Agriculture's Natural Resource Conservation Service and the Environmental Protection Agency should lead the development of an ecosystem analysis and comprehensive life-cycle approach to ethanol feedstock production. This is best accomplished in consultation with the conservation districts, state and private forestry agencies, departments of natural resources and state conservation districts for forested land. The

Natural Resource Conservation Service should then develop standards and specifications for biomass production and harvesting to be included in the field office technical guide.

With any future greenhouse gas credit generating system, there will be a need to differentiate sustainable from unsustainable production practices. A tracking system would help distributors and purchasers of ethanol to verify the as-yet-undefined sustainability aspects of its production. Additionally, diversification of feedstocks is necessary to avoid the impacts of natural vulnerabilities and catastrophic events on sustained biofuel production.

4. **Provide government support to promote new infrastructure and to improve existing infrastructure to harvest and store cellulosic biomass.**

   The feedstock production and transportation infrastructure necessary for biofuels deployment naturally supports a distributed system of smaller refineries than exist in the oil business. A future distributed fuel ethanol market will spread the opportunities for economic development and lead to greater national security in the form of a more decentralized infrastructure for transportation fuels.

   Existing authorization potentially supports R&D in infrastructure, handling and storage of cellulosic biomass, though funds have not yet been appropriated. A preprocessing and harvest demonstration grant program is authorized at $5 million per year for 5 years in Section 946 of the Energy Policy Act of 2005, and these funds must be appropriated. Rural Development grants and other USDA resources can be used to assist in an evaluation of the need. The necessary additional support identified by this evaluation should be funded with urgency.

5. **Carry out research and development to ensure that biomass supply for ethanol complements and does not undermine the production of food, feed and fiber and other plant-based products.**

Agriculture and forestry interests have long been associated with providing safe, abundant and affordable food, feed and fiber. As these industries transition to producing both energy crops and other plant based products, every effort must be made to continue to provide these traditional products. A comprehensive analysis must be initiated to fully examine the future roles of agriculture and forestry interests as they incorporate the new energy crop and plant products into their traditional roles and meet new and rapidly growing demand for cellulosic biomass. This work should be conducted jointly by USDA and DOE and is yet another important product that could be produced by a fully funded Biomass Research and Development Act.

6. **Conduct a study to explore the feasibility of establishing a Strategic Renewable Biofuels Reserve for ethanol production feedstocks.**

   A strategic renewable energy feedstock or ethanol reserve could bolster U.S. energy security by helping to maintain ethanol refineries and by preventing a loss of consumer confidence in ethanol when unforeseen circumstances cause a temporary unavailability of the feedstock or fuel. USDA and DOE should therefore conduct a feasibility study on a biofuels reserve, or the initial study could be funded by private sector groups. Depending on these findings, a strategic reserve for ethanol could theoretically work similarly to the Strategic Petroleum Reserve operated by DOE.

7. **Raise the Renewable Fuels Standard (RFS) to reflect the current growth rate of ethanol production and to reach a 20 billion gallon mandate by year 2016.**

   To ensure a continuing growth market for ethanol production, the current RFS production baseline should be raised to reflect the robust growth of the industry. The current Renewable Fuels Standard schedule should be expanded to reach a 20 billion gallon mandate by 2016. The vision is for ethanol to become cost-competitive, and expanding the RFS is a means to

accomplish this goal. This will reassure farmers planting energy crops, investors in new biorefineries, manufacturers of flexible-fuel vehicles, and providers of retail ethanol filling stations that their investments will not be stranded.

8. **Fund the existing authorized efforts in research, development, demonstration and deployment of biomass-to-ethanol technologies.**

   Examples include fully funding and implementing the grant and loan guarantee programs for commercial projects as authorized under Section 1510, 1511(b) and 9006 of the Energy Policy Act of 2005, and fully funding and implementing the next generation of research and development and new technology pilots as authorized under Section 941 of EPAct 2005 - with urgency.

   Barring a collapse in oil prices, the existing corn ethanol industry will expand to its inherent limits without the need for much additional publicly funded research or demonstration. However, the 100 billion gallon per year goal of ethanol will require major advances in ethanol from cellulose. These advances will require focused research in key conversion areas and demonstration of conversion processes at sufficient scale to improve the economic viability of ethanol from cellulose production and reduce its risk.

9. **Provide incentives to ensure production of ethanol from cellulose.**

   • Under Section 942 of the EPAct 2005, provide a production credit of $0.75 per gallon for 5 years; or

   • Institute a reverse auction for the incentive needed to produce a certain amount of ethanol.

   The first handful of facilities that produce ethanol from cellulose will require special incentives to be built, but in order to encourage rapid deployment the next generation of plants will also need incentives. However, these later incentives should

take a different form and should focus on production rather than investment and financing.

Section 942 of the Energy Policy Act of 2005 would provide a fixed incentive per gallon for the first plants and then would shift to allocating per gallon incentives through a reverse auction. Reverse auctions award incentives to bidders that request the least amount of incentive per gallon, thereby leveraging a fixed amount of government dollars to achieve the greatest amount of production. EPAct2005 authorized $250 million for Section 942 with the goal of reaching one billion gallons of production per year. This full amount should be appropriated, but it is insufficient to achieve the goal and should be increased over time to $1 billion.

10. **Provide a financial incentive to automakers to cover the incremental costs of flexible-fuel vehicle (FFV) production.**

Given the long life of vehicles already on the road, a large percentage of new vehicles sold must be FFVs if investments in ethanol production and ethanol pumps at filling stations are to be profitable. The Alternative Motor Fuels Act of 1988 (AMFA) currently provides an incentive for FFV production in the form of limited credits against Corporate Average Fuel Economy (CAFE) standards. New financial incentives should not be given for vehicles eligible for these credits, should be structured to reward early production of additional FFVs, and should be limited in time.

11. **Extend the existing tax credit for E85 pumps, raise the $30,000 cap on it, apply it per station, increase the percentage (from 30 percent) and phase the credit down over time.**

It is important for successful introduction, capital efficiency and commercial equity that the ratios of FFVs to total vehicles, and E85 pumps to total retail fuel pumps, grow together over time, especially during the start-up phase. Custom engineering pumps and converting gasoline pumps to E85 (removing

aluminum, cleaning tanks, etc.) can be costly, particularly in congested areas or where permitting costs are high. An increased tax credit for a percentage of the cost should be provided to encourage more rapid installation of E85 pumps. The percentage of the costs for which the tax credit can be claimed should be increased now and then phased out over time.

12. **Update federal and California emissions test procedures to ensure equitable treatment of FFVs.**

There are significant problems for testing E85 auto emissions under procedures designed for testing vehicles that run on gasoline. (Because of cold start problems, E85 in the winter can be E71, and E81 or higher in the summer.) Boutique blends vary by geographic markets and within some states. Therefore there is a need to evaluate all testing rules and procedures to ensure that E85 is not handicapped, while maintaining air quality standards. In particular, the California evaporative emissions test for gasoline vehicles is less protective of public health than the test for FFVs, and California and federal exhaust emissions tests did not contemplate E85 when they were developed.

13. **Develop improved fuel specifications for E85.**

To allow engine calibration and to ensure customer confidence, EPA and the California Air Resources Board, in coordination with ASTM, should develop a benchmark for the range of high blend E85 fuel ethanol (e.g., different vapor pressure, seasons, cold start operation). The range for ethanol composition should be specified for season (e.g., a table in the ASTM specification gives a range). Although the product is always labeled E85, starting under cold weather conditions requires more hydrocarbons. The part of the blend that is not ethanol needs to be specified as well to assure that vehicle performance is not compromised due to low quality hydrocarbons being blended with ethanol to produce E85.

14. **Automakers or state departments of motor vehicles should share information about FFV density with E85 retailers, and automakers should collect and share information about pump locations with customers.**

Each state's department of motor vehicles has the VIN numbers of all registered cars, and from those numbers it is possible to identify where FFVs are concentrated. Making this information available to fuel retailers will allow them to install E85 pumps where FFV concentrations are greater. Automakers' sales information is a good proxy for density and should also be made available to fuel retailers.

Knowledge of the location of pumps would make it easier for drivers with FFVs to fill up with ethanol. This information should be collected by automakers from fuel companies or state agencies and made available to owners or potential buyers of FFVs.

15. **Pursue an auto industry commitment to produce FFVs at the maximum feasible pace, taking into consideration U.S. jobs and economic and vehicle life cycle issues.**

National security, oil dependence and climate change add to the urgency for the production of FFVs. Auto manufacturers could be persuaded to commit to aggressive FFV growth with the assurance that an entity like the National Highway Traffic Safety Administration, which understands the industry's economics, would be involved in setting and adjusting the goal.

16. **Educate the public on ethanol, including its benefits to national security, the environment, and the economy, and its impact on mileage and range.**

Motorists are not likely to know that ethanol has lower energy content than gasoline and are therefore likely to react negatively to the lower mileage and lesser range they achieve with E85. Eventually this is likely to be more than offset by the lower price

of E85, but a simple chart in car owners' manuals and on pumps could simplify the calculation and help them understand that E85 can still be a better buy. They are also unlikely to understand how ethanol, especially combined with better fuel economy in general, can contribute to energy security, environmental protection, and economic development. A brief explanation of these benefits should be included in owners' manuals and publicized more generally by government agencies, ethanol manufacturers, and others concerned with these issues.

(Mandates recommended without unanimous support):

1. **Require that 60 percent of all cars and light-duty trucks shipped by each manufacturer be flexible-fuel vehicles by 2013, and**

2. **Require that any entity owning more than 25 retail filling stations provide one E85 pump at 3 percent of all of their stations in the first year of enactment and at an additional 3 percent of stations each year for nine additional years.**

In order to ensure that E85 pumps are available to fuel FFVs and to ensure that FFVs are available to provide customers for retailers who install pumps, it is important for the number of FFVs and the number of pumps to grow in balance. For this reason, and because of the benefits of expanding ethanol use rapidly, many members of the group felt that a minimum rate of growth should be established by law. Others, due to an opposition to government mandates or to confidence in the adequacy of the incentives provided by the recommendations above, did not agree. The proposed mandate on auto manufacturers is reasonably consistent with current and planned FFV production schedules of some manufacturers and therefore is a suitable target for all. The proposed mandate on service stations provides a more gradual expansion in recognition of the fact that not all stations need to have pumps to make E85 available to most motorists at most times. To avoid imposing

an undue burden on small owners, the mandate would only apply to owners of a large number of service stations.

3. **Establish an oil price floor of $40 per barrel to protect the ethanol and other alternative fuels industries and to encourage fuel economy and conservation.**

   Oil prices are not likely to fall below $40 per barrel for an extended period of time and, once established, the ethanol industry is expected to be able to compete with gasoline produced from $40 per barrel oil. But the fear of a temporary oil price collapse, as occurred in 1985-1988 and again in 1997-99 and 2001-02, is a major disincentive to investment in ethanol production. A flexible tax on oil designed to prevent the price from falling below $40 would assure investors that oil exporting countries could not drive the price down to undercut this industry in its infancy.

   Although some participants in the meeting argued that the oil market is in no sense a free market and U.S. government intervention is therefore justified, others were opposed to such market interference. The latter participants believed that an expanded Renewable Fuels Standard could provide the same type of assurances to farmers, processors and others that there would continue to be a market for their products.