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ENERGY POLICY: ABANDON HOPE ALL YE WHO ENTER HERE

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No energy policy discussion is worth having if it does not start with a hard fact: there is no practical alternative to continued U.S. dependence on crude oil imported from nations that at best do not wish us well, and at worst wish us serious harm.[1] To borrow a formulation from Irving Kristol, or perhaps it was Daniel Patrick Moynihan, we do not have an energy *problem,* we have an energy *condition. Problems* can be solved, our energy *condition* can only be coped with—and then only if we act in the future with a greater sense of urgency and greater intelligence than we have in the past. One of the messages of this paper is that no such policy breakthrough is likely, unless we dispose of the myths:

• that we can rely on expanding domestic production or on the output of friendly nations to do more than ameliorate upward price pressures

• that policymakers or markets can affect the demand side sufficiently to end our substantial reliance on imported oil

• that natural gas, wind or solar power, ethanol, or nuclear power are significant and economically viable alternatives to imported oil, 70 percent of which we use for transportation.

There is worse: all plans for a net reduction in worldwide carbon emissions are probably doomed, as we are likely to see more new coal-fired plants in our future than wind machines, solar panels, or nuclear plants. The cumulative effect of objections to expanding domestic production and exploiting available alternatives might so constrain available supplies that we will be forced to rely on reducing the demand for energy. With responses to higher prices likely to take

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[1] Energy independence has long been the stated policy of American presidents, past and future. Those interested in a brief history of that "elusive, but ultimately pointless quest" might look at Ronald Bailey, "Energy Independence: The Ever-Receding Mirage," *Reason* (July 21, 2004). Richard Nixon set that goal in his 1974 State of the Union address, and Jimmy Carter elevated it to a "test [of] the character of the American people … the moral equivalent of war" in a televised address to the nation on April 18, 1977. See Irwin M. Stelzer and Robert Patton, *The Department of Energy: An Agency That Cannot Be Reinvented*, AEI Studies in Policy Reform (Washington: AEI Press, 1996), 7-8. Both Barack Obama and John McCain have declared energy independence to be the goal of their respective energy policies, which also include a continued ban on exploration in the Arctic or offshore, in Obama's case, and for McCain a ban on Arctic drilling, with governors to decide whether to allow drilling off their states' shores.

some time to affect demand, rationing looms large in our future—a development that will please politicians, who see rationing as a means of wresting power from individuals interacting in the market place, and transferring it to governments.

World Supplies

Start with a very quick review of the oil supply situation. About three-quarters of the world's oil reserves are controlled by the OPEC oil cartel.[2] Another 10.4 percent is to be found in the former Soviet Union. North America—Canada, Mexico, and the United States—contains less than 6 percent of the world's conventional reserves, with the U.S. accounting for about half of that, or 2.4 percent. It does not take a mathematical genius to figure out that with 2.4 percent of the world's reserves, and 25 percent of the world's consumption, America must rely on imports. Or that even if all the conventional reserves in Mexico and Canada were reserved for the United States, we would remain heavily dependent on imports from:

• countries not friendly to us (Venezuela with 7.0 percent, Russia with 6.4 percent, and Iran with 11.2 percent account for 24.6 percent of world reserves), or

• countries with regimes that depend on the support of the U.S. military for their survival (Saudi Arabia, reporting 21.3 percent of world reserves, a serious understatement), or

• a country that will struggle to remain independent of Iranian control (Iraq, with 9.3 percent of world reserves and increasing production), or

• countries that are merely unstable (such as Nigeria, with 2.9 percent of world reserves, but production at its lowest level in twenty years because of militant attacks on oil facilities[3] and "no evidence" of an ability to "overcome its internal difficulties"),[4] and

• the OPEC cartel, of which several of the above-mentioned countries are members, and which is likely to become more important in future years as non-OPEC countries find it increasingly difficult to add to existing reserves.[5]

That comes to almost 60 percent of all the world's proved reserves of oil. So our current oil supply situation is precarious, and—important point—cannot be improved significantly even if the long-sought conservative goal of drilling in the Arctic National Wildlife Refuge (ANWR) were to be realized. The Energy Information Agency estimates that if ANWR is opened to leasing and development, production would begin in 2015, peak at 780,000 barrels per day in 2024, and then decline to 650,000 barrels per day in 2030. A bit of perspective: at its peak, production from ANWR would not make up for the 862,000 barrel per day decline recorded from the largely older wells in production in the U.S. during the past half-dozen years.[6] And I suspect that it will not make up for the further declines in domestic production that are likely by 2015.

As for what might be available offshore, the best that can be said is that the congressional ban on geological work makes it impossible to guess at the reserves to be found in formations off the coasts of California, Florida, and other states.

In short, enhanced domestic production, even under the best assumptions about the productivity of new areas, cannot very much change the fact that we must plan to be dependent on imported oil from unfriendly places for the foreseeable future.

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[2] Data on reserves and production from the June 2008 issue of *BP Statistical Review of World Energy,* an annual publication of British Petroleum.
[3] Matthew Green, "Troubled Waters: Nigeria's oil militants take their fight beyond the delta," *Financial Times*, July 2, 2008.
[4] Michael T. Klare, "Clearing the Air," *The National Interest* 93 (Jan./Feb. 2008): 29. Recently, gunmen forced Royal Dutch Shell to shut down the Bonga field, one of Africa's biggest oil fields. "Shell shuts oilfield after gun attack," *Financial Times*, June 20, 2008.
[5] "Non-Opec producers face stalling output," *Financial Times*, July 2, 2008.
[6] Newer fields offshore and in ANWR cannot be explored because of federal and state restrictions, although the latter are being relaxed. More on that below.

The current failure of supply to expand rapidly enough to constrain rapid price increases does not mean that the world is running out of oil—that the "peak oil" theory that is making the rounds is valid … Higher prices *will* bring forth new supplies.

Besides, both presidential candidates have promised to keep ANWR forever in the frozen, pristine state that attracts about 1,000 visitors each year, and to prevent offshore drilling (Obama by an explicit ban, McCain by leaving the decision to state governors, some of whom are the prisoners of their local green constituents, some genuinely convinced that a ban on drilling remains appropriate). Throw in the fact that the rigs and skilled labor needed to explore promising offshore areas are in short supply, and we must look elsewhere for the means of coping with our energy condition.

Which brings us to unconventional supplies, and the possible role of tar sands. If anything approximating the current price of oil is maintained for an extended period, investment in tar sands will continue to increase. Estimates are that major oil companies and others will spend about $100 billion in Alberta, increasing the amount of oil wrung from the area's tar sands to 4 million barrels per day by 2020, from its current level of 1.3 million barrels per day. Other things being equal, that would put Canada right up there with major Middle Eastern producers.[7]

But tar sands are an expensive, dirty source of oil,[8] subject to increasing attack by environmentalists. To meet those attacks the Canadian government has set up two funds, totaling C$4 billion. One will finance a project to capture and store CO_2 emissions from oil sands recovery sites, the other will fund improved public transport.[9] In any event this source of oil will not be reserved for us: we will find ourselves competing for this and other supplies with non-market players, a point to which I will return. Besides, even on the best assumptions, oil from Canada's tar sands,[10] like other supplements to conventional crude supplies, cannot do much more than cover the substantial growth expected in world demand in the next several years. Indeed, even if this new output exceeds growing demand, it cannot be enough to change America's energy condition during what will be a long transition to a less oil-intensive future.

Our dependence on foreign oil, and the current failure of supply to expand rapidly enough to constrain rapid price increases, does not mean that the world is running out of oil—that the "peak oil" theory that is making the rounds is valid.[11] Nor should the pessimism expressed in this paper about the possibility of expanding our own supplies be taken as acceptance of that rather old, and frequently recurring theory now enjoying a revival. In this writer's view that theory is simply wrong—higher prices *will* bring forth new supplies, in America if we allow it, elsewhere unless institutional barriers prevent the higher prices from calling forth as great an increase as would otherwise be the case.[12] One indication that higher prices matter—are an incentive to increased drilling and production—

[7] Canada produces about 3.2 million barrels per day, so an additional 2.7 million barrels from the tar sands would bring its output to about 6 million barrels per day, about 50 percent more than Iran currently coaxes from its reserves. Production data from *BP Statistical Review*.

[8] One critic, surveying the mining operation, described it as "a picture of ecological devastation on a colossal scale.…" Derek Brower, "Alberta's Oil Rush," *Prospect* (February 2008): 54.

[9] Bernard Simon, "Alberta plans to capture CO_2 with surplus oil sands revenue," *Financial Times*, July 9, 2008.

[10] For a brief description of the tar sands industry in the U.S. and Canada see EIS Information Center, "Oil Shale & Tar Sands Programmatic," http://ostseis.anl.gov/guide/tarsands/index.cfm.

[11] Broadly, "peak oil" advocates contend that we have produced so much oil that what remains in the ground cannot sustain current levels of production—production has peaked, and the inevitable decline cannot be reversed by stepped-up exploration and development.

[12] For example, experts such as Professor Peter O'Dell of Erasmus University are estimating that higher prices will add some 5 billion barrels to

comes from Brazil, where high prices have resulted in substantial recent discoveries (primarily the Tupi field) that might come to over 50 billion barrels,[13] about equal to the reserves of Venezuela, and twice those of Nigeria. Still another comes from Saudi Arabia, where King Abdullah has announced plans to invest the necessary billions to expand the Kingdom's production by 50 percent, from its current level of 10.4 million barrels per day to 15 million barrels,[14] including 1.2 million barrels of much-in-demand light, sweet crude from the Khurais field, being developed at a projected cost of $10 billion.[15]

Of course, we cannot dismiss out of hand the possibility that the "peak oil" theorists are correct: they do have considerable support from such diverse sources as Sadad al-Husseini, until 2004 second-in-command at Saudi Aramco, the world's most important oil company,[16] and scholars at the University of California Energy Institute, who note that recent declines in Saudi production coincided with "a doubling in the number of their active oil rigs, leaving some to speculate that the magnificent Ghawar oil field had begun to decline. The necessary data to confirm or refute that conjecture are not publicly available. But it seems likely that if production from Ghawar has indeed already started to decline, the peak in global production cannot be far off."[17]

The policy implications for America of peak oil, however, seem little different from the implications for policy of those who believe with Nansen Saleri, Husseini's successor, that there is plenty of oil in the ground to meet our needs for the indefinite future. Whether the limited supply response to recent high prices is due to artificial, man-made restrictions on exploration and development, or to "peak oil," the price of crude oil is likely to remain high by historic standards, as rising demand from developing nations coincides with either man- or God-made restrictions on supply. Nor is our dependence on suppliers with interests that do not coincide with our own likely to decrease. For policy-planning purposes in the United States it would be the height of folly to assume that there will be large enough additions to domestic reserves, or to reserves in friendly countries, soon enough to change the contours of a sensible energy policy.

World Demand

Which brings us to the demand side. Congress' preferred response to high energy prices is to place artificial restrictions on demand. It has tightened automobile fuel efficiency standards and doomed us to read by dim, ugly, and dangerous light bulbs[18] by enacting legislation that requires us to phase out the 100-watt incandescent light bulb.[19] These and related measures will undoubtedly chip away a bit at our oil and energy consump-

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the 25 billion now estimated to be economically recoverable in Britain's portion of the North Sea. Lorraine Davidson and Angela Jameson, "North Sea 'far from scraping the bottom of the barrel'," *The Times*, June 4, 2008. And Richard Pile, chief executive of the Royal Society of Chemistry, estimates that true proven world reserves are nearly twice conventional estimates. *The Times*, June 5, 2008.

[13] Computed from data in *The Economist*, April 19, 2008, and *Financial Times*, June 9, 2008. Brazil has reserves of about 14 billion barrels, and its finance minister, Guido Mantega, estimates that recent discoveries add between 40 billion and 50 billion to that total. The revenues from the sale of oil will be used to set up a fiscal stability fund and a sovereign wealth fund. "Brazil in $200bn sovereign fund plan" and "Industry concern over control of new fields," *Financial Times*, June 9, 2008. But production will only build slowly, rising from 30,000 barrels per day at present to 100,000 barrels late in 2010, according to José Sergio Gabrielli, president of Petrobas. "Brazil Sets Plan for Oil Reserves," *The Wall Street Journal*, June 11, 2008.

[14] "Global Oil-Supply Worries Fuel Debate in Saudi Arabia," *The Wall Street Journal*, June 27, 2008. At times the Saudis use a figure of 12.5 million barrels per day as their expansion target, rather than 15 million.

[15] "Defiant Saudis rely on Khurais to speak volumes," *Financial Times*, June 25, 2008.

[16] Husseini cites declining output in older fields and derides optimists, among them his successor, who "claim to have some magic potion, like voodoo, that doesn't exist." *The Wall Street Journal*, July 27, 2008.

[17] James J. Hamilton, "Understanding Crude Oil Prices," *Energy Policy and Economics,* no. 023 (University of California Energy Institute, June 2008): 29-30.

[18] See Andrew Ferguson, "A Nation of Dim Bulbs," *The Weekly Standard*, December 31, 2007/January 7, 2008, 8-9.

[19] Australia and Canada, among other nations, have enacted similar legislation mandating the end of sales of incandescent bulbs, to the applause

High prices will do more to curtail the amount of energy we consume, and more efficiently, than most of the measures favored by Congress.

tion, but only a bit, and not soon, as long-lived equipment cannot immediately be replaced with less energy-intensive gear.

High prices will do more to curtail the amount of energy we consume, and more efficiently, than most of the measures favored by Congress. Automobile use is already down about 5 percent; SUVs languish on dealers' lots, unbought and unloved; airline flights are being cancelled as the least fuel-efficient planes are grounded; and utility executives report that their customers are starting to have a different relationship than in the past to their thermostats.

There is reason to believe that the longer-run elasticity of demand—the ability of higher prices to persuade consumers to do with less—is even higher than short-run elasticity: we will see still less consumption of gasoline per mile driven as existing models disappear from our roads (probably to find a second life in developing countries) and consumers find investment in more fuel-efficient vehicles, appliances, and other devices more attractive as energy costs rise. Also, it is helpful that our utilities are getting better at inducing customers to conserve energy at peak times by paying them to curtail use—a sensible economic device, since the payments are less than the cost of additions to peak capacity.

But we should not ignore factors other than price that will moderate the final effect of $100+ oil, $4+ gasoline, and more expensive electricity on demand. Oil is not consumed for its own sake, like a good steak. It is used to do or make other things. In transport, it is only one component of the materials that get us from here to there: other significant costs of automobile use are depreciation and maintenance of the vehicle and insurance premiums. So increased gasoline prices have an attenuated effect on the cost of driving, of which fuel is only one part.[20] Larry Lindsey, former chief White House economic adviser, estimates that a rise in gasoline prices to $6.40 would cut demand only enough to offset one year's growth in the demand for oil in developing countries. What is true for transport is true for the myriad goods—plastics, agricultural products—in which oil is only one of several inputs: any increase in its price will not proportionately increase the price of the goods in which it is embedded.

Add in population growth, and the inevitable development of new, energy-consuming products, and you have some of the ingredients that make it difficult to forecast the combined effect of all the forces acting on the demand for oil and energy, or the magnitude of the *net* effect of higher prices that drive demand for oil down, and higher incomes and new products that drive it up. Perhaps most important is the future trend in personal income. We simply do not know what part of the recent abstemious behavior of consumers—their willingness to forego the Memorial Day and Independence Day drives to the beach—may result from the stalled growth in personal incomes, especially among consumers for whom gasoline accounts for a significant part of household budgets.[21]

Still, it is safe to assume that continued high oil prices will do what economists expect them to do—dampen demand growth, and accelerate the hunt for

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of environmental groups, which estimate that "a worldwide phase out of the inefficient [their characterization] incandescents would reduce world electricity use by more than 3 percent." "Ban The Bulb: Worldwide Shift from Incandescents to Compact Fluorescents Could Close 270 Coal-Fired Plants," Earth Policy Institute, http://www.earth-policy.org/Updates 2007/Update66.htm, May 9, 2007.

[20] But the importance of gasoline prices is magnified by the fact that they are so frequently confronted, whereas depreciation is a hidden and often unnoticed charge, maintenance costs are infrequent although often large when incurred, and insurance premiums nowhere near as prominent in consumers' minds as prices at the pump.

[21] Economists at the Department of Energy estimate that a 1 percent decline in personal income results in a 0.5 percent decline in gasoline demand. "Lower Gas Demand May Endure," *The Wall Street Journal*, June 20, 2008. But it is a good rule not to extend econometric studies beyond the

new supplies and substitutes. But this is a complicated market on both the demand and supply sides, so complicated that the usual econometric techniques are even less reliable than usual, especially since we have little historic data relating to the demand and supply effects of $140 oil. On the demand side, the frequency with which consumers face those high prices at the pump might increase the responsiveness of demand to higher prices beyond what we might expect. On the supply side, the responsiveness of exploration activity to higher crude oil prices is reduced by the refusal of foreign cartelists and resource nationalists to open new areas to exploration, and domestic politicians to engage in economically sensible trade-offs between our need for oil and our desire to prevent unnecessary environmental degradation. So any policy proposals must reflect the uncertainty of underlying calculations about the effects of price on demand and supply.

Natural Gas

Since natural gas is often found in oil-bearing formations, or is located in some of the same areas in which drilling is now barred, the artificial restrictions on oil supply also affect the volume of recoverable natural gas reserves. But natural gas has many characteristics that distinguish it from crude oil. "Natgas produces 50% less CO_2 than coal when used for electric generation and, when used for transportation about 25% less CO_2 than gasoline."[22] Although abundantly available—known reserves are estimated at 60 years' supply at current rates of consumption[23]—natural gas must be liquefied before shipment in international commerce, which creates the need for elaborate liquefaction and port facilities, often opposed by local groups unreasonably fearful of explosions. Even the most vigorous advocates of a major role for natural gas in meeting America's energy needs concede, "The natgas industry is only now beginning to exist as an integrated global industry."[24] As the industry matures, as major oil companies drive down costs by becoming "better at building processing facilities and ships,"[25] it should somewhat ease our dependence on oil. Indeed, natural gas has already replaced oil as a fuel used to heat many households.

But some 70 percent of all known reserves of natural gas lie in the same unfriendly countries on which we now rely for our oil supplies.[26] Unless there is a major expansion of domestic supplies, now inhibited in part by restrictions on drilling in ANWR and offshore, a shift to gas from oil might help reduce CO_2 emissions, but will not alleviate our energy condition.

Alternative Fuels: Wind and Solar

If there is little prospect of improvement in our energy situation from increased supplies of oil or gas, and it is unlikely that artificial and price-related demand constraints will significantly reduce our reliance on oil from suppliers whose geopolitical interests do not coincide with our own, we are left with the possibility that a solution resides in the development of alternative fuels. But the news here is no cheerier: recent energy legislation simply cannot increase the use of alternative fuels sufficiently to make our heavy reliance on imported oil of concern only to those who have refused to trade in their SUVs. As with conservation, alternative fuels might have a place in our energy future, although unlike price-induced conservation, it might be a place made possible only by heavy subsidies. Vic Abate, vice president for renewables at GE Energy, estimates that unsubsidized wind energy costs 8-10 cents per kilowatt

range of known observations, and we have little data on the effect of income declines on gasoline consumption when gasoline prices are well above $4 per gallon.

[22] Robert A Hefner III, "The Age of Energy Gases: The Importance of Natural Gas in Energy Policy," in *The Global Politics of Energy,* ed. Kurt M Campbell and Jonathan Price (Aspen: The Aspen Institute, 2008), 150.

[23] *BP Statistical Review,* 22.

[24] Hefner, "Age of Energy Gases," 158.

[25] Carola Hoyos, "Growth gives gas its day," *Financial Times*, June 30, 2008.

[26] *BP Statistical Review,* 22.

hour, and solar more than 30 cents, while coal, gas and nuclear are in the 5-10 cent range.[27]

The good news is that the wind and solar industries are growing rapidly as costs decline, that investment in renewables in 2007 was 60 percent above the 2006 level, and that the money poured into renewables thus far in 2008 exceeded the sums invested in the same period in 2007.[28] In the case of solar, prices for solar components have already fallen, and are expected to decline by another 50 percent by 2010,[29] which would put solar power at "grid parity"—equal to the cost of fossil fuel-based power.[30] As for wind, better turbines and higher production volumes are driving down the costs of wind-power generation.[31]

This is not the place for an in-depth review of the long-term economic viability of wind and solar power. Suffice it to note that the wind business is growing at an annual rate of 30 percent;[32] analysts at CLSA, an investment banking group operating in Asia-Pacific markets, estimate that utilities and governments in the U.S., China and Europe will spend $150 billion on wind projects in the next five years.[33] (Germany and Spain lead the parade, the U.S. coming in third with over 11,000 megawatts, but gaining ground.) Solar revenues are predicted to triple over the next five years:[34] GE expects its solar-energy business to hit the billion-dollar annual revenue mark within three years, up from $100 million at present.[35] Q-Cells, the world's largest independent manufacturer of solar gear, plans to invest $3.5 billion in Mexico to supply the U.S. and Latin America with solar panels,[36] and Norway's Renewable Energy Corporation ASA has announced plans to invest $2.51 billion in a new plant in Singapore to produce solar-panel components.[37]

If society worries sufficiently about the effects of global warming to bear the costs of the subsidies needed to attract capital to these sources, or if carbon prices are sufficiently high, wind and solar power will continue to grow. John Llewellyn, senior economic policy adviser at Lehman Brothers, estimates that the carbon price needed to make offshore turbines economic is $150/ton, and for solar thermal electricity is $500/ton,[38] estimates recently verified in good part by the International Energy Agency.[39] That is well above the level of around $40 currently set in Europe's cap-and-trade market.[40]

Three factors, however, will in the end keep wind and solar minor players in our energy future—the need for and unreliability of government subsidies, siting opposition, and geographic remoteness from electricity grids:

• "The subsidy regimes underpin the economic viability of renewable energy everywhere," notes James Knight, a renewable-energy specialist with Augusta Co., a London merchant bank specializing in energy finance.[41] Not exactly the sturdiest of underpinnings: "Government subsidy is a wobbly foundation on which to build

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[27] "Hopes of breathing life into wind power," *Financial Times*, June 18, 2008.

[28] United Nations Environment Programme data reported in "Spending on renewables accelerates," *Financial Times*, July 2, 2008. Most interesting is the decision of Blackstone, the buy-out group, to invest €1 billion in a wind farm off the coast of Germany, "in a sign that investors are ready to commit substantial sums to alternative energy projects while oil prices seem set to remain high." James Wilson and Fiona Harvey, "Buy-out group to invest in wind farm," *Financial Times*, July 10, 2008.

[29] "Silver lining in solar power storm clouds," *Financial Times*, June 2, 2008.

[30] David Cohen, head of clean technology at Morgan Stanley in California, puts the date at 2012. "Shedding Light on Solar," *Wall Street Journal*, July 1, 2008. See also "Squeeze is on as interest grows in solar sector," *Financial Times*, June 2, 2008.

[31] See, for example, "Green Dreams," *The Economist*, November 18, 2006.

[32] "Headwinds," *The Economist*, March 31, 2007.

[33] Reported in *International Herald Tribune*, June 4, 2007.

[34] *Financial Times*, June 2, 2008.

[35] Estimate by John Krenicki, CEO of GE Energy, reported in "GE sees solar becoming $1 billion business," Reuters, June 2, 2008.

[36] "Q-Cells to build Mexican solar plant," *Financial Times*, June 6, 2008.

[37] "New Plant to Make Solar Cells," *The Wall Street Journal*, June 19, 2008.

[38] "It is time to get a grip on the cost of carbon," *Financial Times*, September 20, 2007.

[39] "IEA calls for energy revolution," *Financial Times*, June 7-8, 2008.

[40] As of early June the price was $43 per ton. *FT.com*, June 7, 2008.

[41] "Can renewable power earn profits?" *The Wall Street Journal*, March 22, 2007.

a business,"[42] especially in America, where the federal tax credit for wind has been allowed to expire three times in recent years.[43] As for solar, Germany, which is the biggest market, accounting for about half of total world demand, plans to cut subsidies by 7 percent next year[44] even though the solar devices on the market are "six, seven times more expensive than wind."[45]

• Opposition to the siting of many wind farms is not confined to the Kennedys, who resent any interference with the view from their Hyannisport compound. It includes countryside alliances of various sorts and, most important, defense authorities who have discovered that wind farms interfere with the ability of radar to detect low-flying planes,[46] a discovery that has prompted an investigation by the NATO Research & Technology Organisation, and the attendance of U.S. officials at tests by Britain's Air Warfare Centre.[47]

• A wind farm or large-scale solar installation is of little use if it is not connected to the grid, and the remote location of these facilities often—not always—makes connection so expensive that regulators are reluctant to force even more-reluctant grid operators (especially those that own generation facilities) to extend their networks. And environmental groups often oppose the construction of transmission lines, creating long, expensive delays in the licensing process. Major transmission projects take up to four years to win approval from regulatory authorities. "The process just doesn't work," says Joseph Welch, CEO of ITC Holdings, a transmission company.[48] At least, not in America, with the apparent exception of Texas. In Germany the utility RWE has announced that it will spend €2.2 billion to expand its power grid, partly because it has to reach out to wind farms located far from population centers.[49]

Alternative Fuels: Ethanol

The situation with ethanol is even more interesting than that of wind and solar, especially from a policy point of view. Congress' and the President's enthusiasm knows—or knew[50]—no limits. Well, some limits, since our government refused to lower tariffs on sugar-based ethanol imported from Brazil,[51] although Congress left a loophole that permits ethanol from the Caribbean to enter duty-free if the feedstock was from that region. Suffice it to say that proponents of ethanol as an alternative to crude oil and its products, or a supplement to it, failed to reckon with the effect that conversion of large swaths of the world's land to growing fuel, instead of food, would have on food prices,[52] which are in any event subject to upward pressure from the increased affluence of large populations in the so-called developing world, or on the fact that the net energy gain from ethanol is somewhere between negligible and negative.[53]

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[42] *The Economist*, November 18, 2006. The durability of the subsidy regime in the past several months suggests that this risk may be decreasing.
[43] *The Economist*, March 31, 2007.
[44] *Financial Times*, June 2, 2008.
[45] "GE sees solar becoming $1 billion business," Reuters, June 2, 2008.
[46] "Two targets, one dilemma: to defend the Earth or the skies?" *The Times*, February 4, 2008.
[47] "Nato investigates wind farms after air defence threat," *The Times*, February 5, 2008. A report is due in 2010.
[48] "Wind. The Power. The Promise. The Business," *BusinessWeek*, July 7, 2008.
[49] Wilson and Harvey, "Buy-out group to invest in wind farm" (see fn. 28 above).
[50] "Corn Ethanol Loses More Support," *The Wall Street Journal*, May 3-4, 2008. See also, "Food cost may force rethink on biofuel," *Financial Times*, April 23, 2008, for a summary of second thoughts on biofuel policy in Europe.
[51] In an example of the distorting effects of tariffs and subsidies, plants are being built in the Caribbean to process Brazilian ethanol by extracting water from it, after which it is re-exported duty free to the U.S. "Avoiding the tariff—that's the economics of our business," EthylChem's Ron White told *The Wall Street Journal,* March 12, 2007.
[52] The precise effect is subject to some dispute. At the UN High-Level Conference on World Food Security the U.S., Canada, and Brazil claimed that the diversion of crops for biofuel has added only 3 percent to the rise in world food prices; the IMF and various international agencies put the figure at up to 30 percent. *The Times*, June 6, 2008. After some heavy crop-damaging rains, corn prices hit $6.63¼, up 45.6 percent on the year. "Weather pushes US corn to record," *Financial Times*, June 7/June 8, 2008.
[53] A good summary of the arguments against continuing ethanol subsidies is found in William Tucker, "Food Riots Made in the USA," *The Weekly Standard*, April 28, 2008.

The results are grist for the mill of the "unintended consequences" crowd. Georgia's politicians' enthusiasm for corn-based ethanol faded when the state's chicken, dairy, and pig farmers complained that the rising cost of feeding their flocks and herds is ruining them,[54] while farmers in Pennsylvania have switched from corn to trimmings from the wafers that go into Kit Kat bars, and North Carolina's pig farmers are relying more on trail mix, French fries, and candy bars. In Italy, government price guarantees for biofuel crops give farmers about twice the income per acre they were earning from growing wheat,[55] contributing to a worldwide shortage of wheat.

There's more. To grow all of this corn, America has had to increase imports of nitrogen-based fertilizers supplied by countries on which we are already overly dependent for oil supplies.[56] And irony of ironies, it turns out that biofuel alternatives to oil-based gasoline actually increase carbon-dioxide levels when the full emissions costs of producing these biofuels are taken into account. "Most of the biofuel that people are using or planning to use would probably increase greenhouse gases substantially," Princeton environmental researcher and economist Timothy Searchinger reports after extensive study. "We're making climate change worse," adds Joseph Fargione, a scientist at the Nature Conservancy.[57] And even Sir Nicholas Stern, he of the famously economically illiterate Stern Review on the Economics of Climate Change,[58] worries about the large drain on available water supplies created by biofuel production.[59] All of which led the Organisation for Economic Co-operation and Development (OECD) to recommend the phasing out of biofuel subsidies and the levying of carbon taxes to allow the market to find the most efficient way of reducing greenhouse gases.[60] Indeed, most European officials now agree that the rise in food prices and the massive deforestation caused by growing use of biofuels require that its original goal—biofuels to account for 10 percent of Europe's transportation fuels by 2020—must be scaled back drastically.[61]

Please understand. Not all of the attacks on corn-based ethanol are justified. Production of corn in the U.S. last year was sufficient to supply the domestic market, increase exports to record levels, and stockpile a 10 percent surplus, even after 22 percent of the crop went to produce seven billion gallons of ethanol. But it is obvious that diverting 22 percent of the crop to non-food uses—that figure will rise to 33 percent in the 2008-2009 season[62]—contributed to the price increases that brought corn prices to about twice the levels that prevailed in 2005, the farm lobby's denials notwithstanding.[63] All in all, it is generally agreed that corn is not the right crop to use for biofuels.[64] More important, the costs of ethanol production, in the opinion of one careful student of the costs and benefits of that production, "are likely to exceed benefits by about three billion dollars annually in 2012 if current policies continue. . . ."[65]

The story of Brazil's sugar-based ethanol industry is

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[54] "Ethanol's Bitter Taste," *The Wall Street Journal*, May 18, 2007.
[55] "Europe Pushes to Get Fuel From Fields," *The New York Times*, May 30, 2007.
[56] *Financial Times*, March 27, 2007.
[57] "Studies Call Biofuels a Greenhouse Threat," *The New York Times*, February 8, 2008.
[58] Published by Cambridge University Press in 2007. Devastating critiques include Freeman Dyson, "The Question of Global Warming," *The New York Review of Books*, Vol. 55, no. 10 (June 12, 2008), and William D. Nordhaus, "A Review of the Stern Review on the Economics of Climate Change," *Journal of Economic Literature*, Vol. XLV (September 2007): 686-702. Stern rejects the idea of discounting future costs and benefits when they are compared with present costs and benefits because that discriminates between present and future generations. The result is to impose enormous costs on present generations to obtain trivial benefits for later ones.
[59] "Warning to biofuel producers to give up sugar," *Financial Times*, June 19, 2007.
[60] "OECD warns biofuel drive will push up food prices," *Financial Times*, September 11, 2007.
[61] "Europeans Reconsider Biofuel Goal," *The New York Times*, July 8, 2008.
[62] Estimate by Department of Agriculture reported in *Financial Times*, May 10-11, 2008.
[63] Alan Beattie, "US farm lobby defends biofuel," *Financial Times*, May 2, 2008.
[64] "Is Ethanol Getting a Bum Rap?" *BusinessWeek*, May 12, 2008.
[65] Robert W. Hahn, "Ethanol: Law, Economics, and Politics," Reg-Markets Center Working Paper 08-02, January 2008, available at http://ssrn.com.abstract=1082079.

a happier one, or at least seems so in the absence of reliable data on the subsidies expended to get it started. It is said to be competitive with gasoline when the price of crude is above $40 per barrel, and massive planned investments in mechanization and a pipeline network to move ethanol from the interior to the coast will allow a doubling of output by 2015.[66]

Alternative Fuels: Nuclear

Which brings us to the most highly touted of all the technologies that are supposed to reduce our reliance on imported fuel: nuclear power. There are now some 104 nuclear plants operating in the U.S., about half of which operate under licenses that are due to expire between 2009 and 2015.[67] GE says 44 new reactors will be built, worldwide, by 2020; Areva, the French firm, is predicting that 130 new plants will be online by 2030,[68] and has received assurances that the British government would not consider it a violation of competition law if Areva were successful in installing its technology in all new reactors built in the United Kingdom.[69] Britain's Prime Minister Gordon Brown is calling for the construction of more new plants than will be required merely to replace those being retired in the UK.[70] And Italy, the largest net importer of energy in Europe, plans to resume construction of nuclear stations some twenty years after a public referendum banned nuclear power and deactivated existing plants—assuming the government can overcome the vigorous opposition of environmental groups, who are demanding that a referendum be held, and that Italy rely on solar power for its increasing energy needs,[71] or on wind power, to which Enel, Italy's largest power utility, has committed €500 million for the construction of 115 turbines off the southern coast of Sicily.[72]

Nuclear proponents cite several reasons for their optimistic assessment of the future role of nuclear power:

• The rising price of fossil fuels should make nuclear more economic.

• Persistent increases in the demand for electricity, and the increased pressure on utilities not to build coal plants, makes nuclear seem more attractive.

• Nuclear plants do not emit greenhouse gases.

• The Energy Independence and Security Act (EISA) of 2007 provides the Department of Energy with authority to guarantee loans arranged to finance construction of nuclear plants.

• Many experts are increasingly nervous about the ability of natural gas supplies to keep pace with the demands created by new power plants if nuclear is not part of the supply mix, especially since hopes for liquefied natural gas (LNG) are not yet being fully realized.

• Congress has taken steps to reduce the time required to license new plants.

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[66] Marcos Jank, president of Unica, Brazil's sugar cane industry association, reported in *The Times*, June 7, 2008.

[67] License extension is rarely denied, although environmental groups have lately been raising the question of whether metal fatigue might create a safety hazard if these plants are allowed to continue operating for an additional twenty years. See "Nuclear-Plant Analysis Ordered," *The Wall Street Journal*, April 18, 2008.

[68] "Nuclear Power: Half Life," *The Economist*, November 11, 2006.

[69] This is quite possible since both Eon and EDF, energy companies, have announced their support for the Areva technology. "UK reactor assurances boost Areva," *Financial Times*, June 9, 2008.

[70] "Brown presents nuclear option as the answer to reducing dependence on oil," *The Times*, May 29, 2008. Britain has already retired several nuclear plants; all save one of its newer reactors will be shut down by 2023. *The Economist*, April 5, 2008. The need for new plants makes the UK "the most exciting place in Europe" for nuclear power, says its CEO, Anne Lauvergeon. *Financial Times*, June 9, 2008. Brown estimates that by 2050 the world will need 1,000 nuclear power stations. "Pump more oil and put the profits into British renewables, Brown tells Opec chiefs," *The Times*, June 23, 2008.

[71] "Italy Plans to Resume Building Atomic Plants," *New York Times*, May 23, 2008.

[72] Guy Dinmore and Fiona Harvey, "Enel plans €500m wind farm off Italian coast," *Financial Times*, July 11, 2008.

But there are reasons to doubt that we are on the verge of a nuclear renaissance.

• Operators have become more efficient in running and maintaining nuclear plants than they were when new construction halted.

As a result of all of these developments, and of the EISA incentive available for a limited number of plants on a first-come, first-served basis, U.S. utilities have started to develop plans for about 32 new plants (the Nuclear Energy Institute puts the number at "about 40"),[73] and applications for two of those plants have been filed. The new plants would be added to the 104 existing plants that now account for about 20 percent of U.S. power production.

But there are reasons to doubt that we are on the verge of a nuclear renaissance. First, there is the question of cost—and here we enter a veritable minefield of conflicting and ever-changing data. The industry, which as recently as around 2003 was estimating the cost of nuclear capacity at about $2,500/kW, now puts the figure at $4,000/kW.[74] History suggests that we should approach all such estimates with great care. Indeed, already there are noises—coming from Moody's and indirectly from the Department of Energy—that a more realistic figure is $6,000/kW,[75] a figure nuclear advocates argue will come down after the first generation of new plants is completed. But many of these advocates had been pinning their hopes on the next-generation nuclear plant being built in Finland by Areva, a project that is now two years behind schedule and more than $1.5 billion over budget.[76]

Those of us who have followed the nuclear industry since its inception remember that the cost of the Shoreham plant on Long Island, never opened because Governor Mario Cuomo bowed to political pressure, was originally estimated at $350 million and turned out to be something like $5.4 billion, and Georgia Power's Vogtle plant, which was put into service in the late 1980s, came in at ten times its original estimate. But even at $4,000/kW, GE CEO Jeffrey Immelt estimates that "In all practicality … the US will be lucky to replace its current [nuclear] capacity" absent "a meaningful price" on carbon-dioxide emissions,[77] estimated to be $60 per ton of CO_2,[78] 50 percent above the current price in Europe. John Rowe, CEO of Exelon, which is the largest operator of nuclear plants in the U.S.—and a highly efficient operator at that—says, "The country badly needs new nuclear plants to deal with the climate issue. But they are very expensive, very high-risk projects."[79]

Remember: power from some of these stations would have to compete in the market with power from gas- and coal-fired stations, and studies conducted at the University of Chicago *before* the recent run-up in capital and materials costs put even the lowest of cost estimates for new nuclear plants coming on line in the next decade at well above the cost of coal- and gas-fired plants,[80] a conclusion supported by the

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[73] Angelina Howard, "Forecast For The Nuclear Industry," Dialogue I on The Energy-Competitiveness Relationship (Council on Competitiveness, September 13-14, 2007), 20.

[74] Mitsubishi claims it can put capacity on line at a cost of only $1,500/kW, using a reactor design that has not yet been approved for use in the U.S. "I'd say a lot of ears would perk up if that happened," commented Craig Nesbitt, spokesman for Exelon's nuclear unit. "TXU abandons coal plan for nuclear-power plants," *The Wall Street Journal*, April 12, 2007.

[75] Energy Secretary Bodman suggests that a plant will cost about $10 billion. Assuming he meant a large, 1,600MW plant, that comes to more than $6,000/kW.

[76] "Nuclear's Tangled Economics," *BusinessWeek*, July 7, 2008.

[77] Quoted in "GE chief's fears over atomic power," *Financial Times*, November 19, 2007.

[78] "No To Nuclear," *Wall Street Journal*, June 30, 2008.

[79] Quoted in "Nuclear's Tangled Economics," *BusinessWeek*, July 7, 2008.

[80] "The Economic Future of Nuclear Power," a study conducted at The University of Chicago, August 2004, directed by Professor Emeritus

Congressional Budget Office, which finds: "In the absence of both carbon dioxide charges and EPAct incentives, conventional fossil-fuel technologies would most likely be the least expensive source of new electricity-generating capacity."[81] Unfortunately for the nuclear advocates—although perhaps fortunately, given their inability to recover nuclear costs in the "good old days" of cost-plus regulation—the days of utility cost-plus pricing went out with old-style deregulation in many areas.[82]

There are other problems. The Nuclear Regulatory Commission (NRC) will also have to find some way to keep the nuclear-plant licensing process to the three years now being assumed by optimists, no easy chore given the ingenuity of the anti-nuclear groups in extending hearings. Also, nuclear advocates will have to persuade Congress, including the sworn opponent of the Yucca Mountain Repository, Senate Majority Leader Harry Reid, who hails from Nevada, to fund the $70-$80 billion it will take to construct the nuclear waste storage facility in his state. And that legislative battle will take place only if the NRC accepts the Department of Energy's application, twenty years in preparation, to operate the Repository, and expeditiously completes the process of reviewing the application, now scheduled to consume a mere three years.[83] The already-slim chances of a nuclear revival will become slimmer still if Barack Obama is the next occupant of the White House. After first declaring that "Nuclear energy is not optimal," the Illinois senator now professes to have no special animus towards carbon-emission-free nuclear power, but will support the licensing of new plants only if there is a long-term solution for storing nuclear waste—and he opposes the opening of the Yucca Mountain Repository.

Finally, there is the perennial question of safety. It is fashionable in pro-nuclear circles to point out that no American has ever died in a nuclear accident, and that the new designs are far safer than those built over two decades ago.[84] But we must also note that the new designs with which we will be dealing are untested in practice, that the supply of experienced and knowledgeable engineers and technical staff has been much reduced by the recent inactivity in the industry, and that EDF, perhaps the world's leading builder of nuclear plants, was recently ordered by France's nuclear safety authority to halt work on its flagship new 1,600 MW nuclear power station in northern France after inspectors found deficiencies in quality controls.[85] No safety threat was found, but it is a safe bet that this and other such inevitable incidents will be grist for the mills of those who will attempt to halt nuclear construction in the United States. And it is certain that they will be undeterred by the fact that the mining and burning of coal has taken more lives than U.S. nuclear plants.

In the end, there seems little doubt that nuclear plants, at least the first of the new breed and perhaps their successors if costs fail to come down, will need some form of financial assistance from government to be economically viable—either overt subsidies[86] or covert support in the form of long-term price guarantees. Potential investors in nuclear plants in the UK's highly competitive electricity market are already demanding such guarantees.[87] One thing is certain: the $18.5 billion in loan guarantees made available by EISA won't do much to get more than a few plants built—if it even does that.

Besides, it is difficult to see how even a wave of

George S. Tolley and Donald W. Jones, vice president of RCF Economic and Financial Consulting, Inc.

[81] Congressional Budget Office, "Nuclear Power's Role in Generating Electricity," May 2008, 2. The CBO estimates that nuclear becomes competitive if carbon sells for $45 per ton (2006 dollars), which is within range of the current price on the European exchange. Most industry operators put the figure considerably higher.

[82] Exelon, the nation's biggest nuclear-plant operator, operates so-called "merchant plants" that sell their power competitively. In states such as Florida and Georgia, utilities still operate on a cost-plus basis, and have to rely on their regulators to allow them to set rates that recoup construction and operating costs. See "New Wave of Nuclear Plants Faces High Costs," *The Wall Street Journal*, May 12, 2008.

[83] "Yucca Move Is Part of Nuclear Agenda," *The Wall Street Journal*, June 4, 2008.

[84] These designs involve far less piping and fewer other components that are more worrisome, and decrease the probability of human error.

[85] "EDF ordered to halt work on reactor," *Financial Times*, May 28, 2008.

[86] The government already assumes liability for catastrophic damages in excess of $10.5 billion in the event of an accident.

[87] "A Level Playing Field," *The Wall Street Journal*, July 1, 2008.

nuclear construction can do much to reduce demand for oil, absent a massive shift to electric-powered vehicles.[88] Such a shift is not impossible, but neither is it likely, even if Senator McCain's promise of a $300 million bonus to the inventor of the next generation of batteries is thrown into the incentive pot. The current generation of batteries need to be charged too frequently, except for those that are uneconomically expensive. That, at least, is the view of such experts as Professor William Hogan of Harvard's Kennedy School, a longtime student of the energy industries. I tend to share that view, but should note that a Hudson Institute colleague, Rod Hunter, is persuaded that the electric car, which does not need "costly engines or complex transmissions like today's autos," is or soon will be cost-competitive with gasoline-powered vehicles.[89]

Worse still, the industry estimates that no new nuclear plants will come on line before 2016-2017, at which time between four and eight plants might begin operation[90]—and the industry has typically been more than a little optimistic. One more dispassionate expert, Willie Heller (director of Falck Renewables, a wind farm developer), tells me, "Put me down for 2020." He is most likely correct. So, in the period during which we must cope with our energy condition, nuclear cannot be counted on to ease that condition.

Our Energy Condition

Here is the situation we face:

• The demand for energy of all sorts, especially oil, is rising and will continue to rise, although high prices, if sustained, will slow the rate of increase, except in markets—and there are many such, especially in the developing world—in which energy use is subsidized and users shielded from rising oil prices.

• The supply of oil will not respond to higher prices as it would in a free market because (a) that's not what cartels do, (b) nationalist considerations will prevent many producing countries from calling on Western expertise to improve production from old wells and explore for new reserves, a triumph of nationalism over economics, reducing investment to sub-optimal levels, and (c) U.S. policy will continue to constrain domestic supplies of crude oil.

• America's profit-driven oil companies, responsible to their shareholders, will be disadvantaged in their competition with state-run entities for new supplies. The latter can incorporate any externalities related to their nations' interests in their bidding and investment decisions, which American companies cannot do.

• Nations controlling the bulk of the world's supplies have agendas hostile to U.S. foreign policy interests.

• Neither alternative energy sources nor artificial constraints on demand will be sufficient, in any time period in which policy planning is relevant, to significantly reduce our dependence on foreign oil.

• Oil prices at anywhere near current levels will continue to swell our trade deficit; fund Iran, Venezuela and other countries opposed to "broader American interests"; and increase the holdings of U.S. government IOUs, and therefore the potential influence, of "the wrong people."[91]

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[88] Tolley and Jones' 2004 report prepared at The University of Chicago does note, "Nuclear energy could help ease oil security concerns if hydrogen is cogenerated for transportation." p. S-22.

[89] Rod Hunter, "The Market Is Responding to the Oil Shock," *The Wall Street Journal*, July 8, 2008.

[90] Estimate by Marvin Fertel, chief nuclear officer at the Nuclear Energy Institute, reported in *European Power Daily*, Vol. 10, Issue 69, April 9, 2008.

[91] Gerald F. Seib, "Pump Prices Hurt Americans Not Just in Pocketbook," *The Wall Street Journal*, July 8, 2008. Seib notes that "some of these mountains of petrodollars will … be used to advance anti-American political agendas."

Given all of that, what are some ingredients of a sensible energy policy?

Policy Possibilities

FIRST, we should of course attempt to expand domestic supplies after carefully analyzing the costs—including social costs—and benefits of opening ANWR, offshore California and Florida, and federal lands to exploration and development. With the governor of Florida now willing to allow some offshore exploration,[92] perhaps because gasoline now consumes 12 percent of Floridians' incomes, perhaps because offshore rigs withstood the onslaught of Hurricane Katrina,[93] perhaps because the tourist trade now sees high gasoline prices as a greater threat than the sight of far-off drilling rigs,[94] such studies of the feasibility of lifting the federal moratorium might begin there. With oil at anything like current price levels, we probably will find the benefits of developing new supplies exceeding the costs, although the absence of recent geologic surveys—outlawed by Congress—makes all of this guesswork. But in any event, increased domestic drilling can only be part of a sensible coping policy, and a small part at that. Both presidential candidates are opposed to opening up ANWR; Senator Obama is opposed to drilling offshore and Senator McCain unwilling to have the federal government override state governors; the most promising acreage lies off the California coast, and the governor of that state is unalterably opposed to drilling. Besides, there is virtually no prospect that reserves that might become available will come on line "within 5 to 10 years from currently inaccessible areas"[95]—probably longer, given the time required for environmental impact studies by the U.S. Minerals Management Service, the worldwide shortage of ships used for deep-water drilling, and for the construction of the necessary pipelines and other facilities.

SECOND, we should diversify our supply sources, even if this involves limited but economically efficient subsidies to private-sector companies. But diversity of supply sources, and the addition of new supplies to those now available, will not be easy. Even in perfect markets supply responses are not instantaneous. And we are not dealing with anything approaching a perfect market. New supply sources do not seem to be coming to market in significant volumes. As Paul Portney, former head of Resources for the Future and now dean of the Business School at the University of Arizona points out, we economists seem to have overestimated the effect of high prices on the development of new supplies of crude oil. For one thing, producing countries, with the possible exception of Saudi Arabia, have not responded to new price incentives with enthusiasm. In fact, higher prices and the resultant increased revenue from current production seem to have reduced the need of many producing countries to increase output—a circumstance economists call a backward-sloping supply curve.[96] Portney has a point: during the recent period in which oil prices have risen by about 60 percent, exports by the world's top oil producers have fallen by 2.5 percent, although prices are not the only variable here.

We also may have underestimated the cost of developing new reserves, and therefore the price that private-sector oil companies need to be assured is the new floor if they are to make major investments. Cambridge Energy Research Associates estimates that the cost of developing a new oil or natural gas field

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[92] "Governor Backs Florida Drilling," *The Wall Street Journal*, June 18, 2008.

[93] "Florida becomes battleground for oil pipe dreams," *Financial Times*, June 21-22, 2008.

[94] That is the new position of Nicki Grossman, vice-chairman of the Florida Tourist Commission, reported in "Idea of Offshore Drilling Seems to Be Spreading," *The Wall Street Journal*, June 19, 2008.

[95] *Hard Truths: Facing the Hard Truths about Energy*, a report of the National Petroleum Council, Lee R. Raymond, Chair, Committee on Global Oil and Gas (July 2007): 20. Government estimates, based on very little geologic data, put reserves available in offshore areas now off-limits to exploration at 18 billion barrels. "Lifting Ban Wouldn't Be Immediate Fix for Oil," *The Wall Street Journal*, June 19, 2008.

[96] This phenomenon is seen also in the more mundane taxicab industry. Higher per-mile fares permit many drivers to meet their income goals in fewer hours, and so reduce the supply of cabs, at least in the near and medium terms.

We should diversify our supply sources, even if this involves limited but economically efficient subsidies to private-sector companies.

has doubled in four years because of shortages of equipment and skilled personnel.[97] The good news is that these costs just might be leveling off, according to Norway's national oil company.[98]

Another factor producing a sluggish response of supply to rising prices is nationalism—a deeply held feeling in many countries that oil is their patrimony, their life's blood. Private-sector (especially Western) participation in the development of reserves in the Middle East and elsewhere is severely limited by this "resource nationalism."

Finally, supplies available to America are further limited by the locking up of resources by foreign companies acting on behalf of their governments, rather than as mere market-oriented players.[99] Here, a bit of sophisticated arithmetic and more reliance on government than we would ordinarily prefer is in order. As mentioned earlier, our profit-making private-sector companies are competing all over the world with state-run or state-beholden entities. These entities benefit both from subsidized capital and from the incorporation of national interest considerations into the prices they are able to pay for drilling rights and for supplies. So Chinese companies can afford to back their bid for access to Nigeria's reserves with a $2.5 billion government loan for infrastructure projects;[100] gain drilling rights and supplies in Saudi Arabia by including in the package permits for Saudi oil companies to build refineries in China to refine heavy Saudi Arabian crude[101] that many refineries around the world cannot process economically; and provide Angola with billions of dollars in loans from China Export-Import Bank to rebuild infrastructure, and thereby help Sinopec, state-owned and funded, to secure exploration and production assets.[102] Our private-sector companies, of necessity driven by a need to maximize shareholder value, cannot do that, and therefore give no weight to national security interests when they do their investment planning.

To eliminate that disadvantage, we might consider having the government supplement the bids of our private-sector players, either by direct subsidies or some tax arrangement, so that our national interest is reflected in the calculus underlying supply-enhancing decisions. As one informed observer has noted, "The willingness of countries to use fossil fuel as a tool of foreign policy has been increasing in recent times. And when we think that 90 percent now of oil reserves are state-controlled we can easily see the limitations of a traditional free market in regulating the process."[103] Of course, *any* additions to world supply are useful to us since the oil market is a global market. But we still need to be concerned about who owns the reserves. Which means, for example, that it might be sensible to subsidize the development of Canada's tar sands, in return for contractual access to the reserves.[104] We also

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[97] Daniel Yergin, "Oil has reached a turning point," *Financial Times*, May 28, 2008.

[98] "Norway oil chief says costs are stabilising," *Financial Times*, May 14, 2008.

[99] Indeed, Admiral Timothy J. Keating, head of the U.S. Pacific naval command, has warned that the scramble for energy resources, especially in the South China Sea where China's claims are disputed by several other countries, might create a crisis. *Financial Times*, June 2, 2008.

[100] "China oils Nigeria talks with $2.5 bn projects loan," *Financial Times*, April 22, 2008. "Continued and expanded U.S. access to African energy is by no means certain as other suitors are already lining up to secure future supplies." National Petroleum Council, *Hard Truths,* 225.

[101] For an interesting discussion of this and related issues see Will Hutton, *The Writing on the Wall: China and the West in the 21st Century* (London: Little, Brown, 2006), 232-240.

[102] Jeffrey A. Bader, "Rising China and Rising Oil Demand: Real and Imagined Problems for the International System," in Campbell and Price, *Global Politics of Energy*, 104.

[103] Liam Fox [UK Shadow Secretary of Defence], "Energy Security," a talk to members of the Economic Research Council, 18 December 2007, reprinted in *Britain Overseas*, Vol. 38, no. 1 (Spring 2008): 3.

[104] As more tar sands resources are developed around the world, technology may improve, reducing costs and environmental impacts. Eni, the

need to reconsider policies that led the EPA to reject Conoco's plans to expand its Illinois refinery so that it could process more of Canada's heavy crudes—this despite the approval of the state EPA.[105] We need to do all we can to diversify our supply sources, but don't seem to be willing to do what is necessary to pay for it.

THIRD, we should integrate energy policy into foreign policy—it is close to absurd to allow billions in remittances to go to Mexico from immigrants working here, while the Mexican government bans the U.S. investment that is necessary to reverse the decline in that country's oil production, particularly from its ageing Cantarell field, a decline in overall production that Mexico's energy minister says will make Mexico a net oil importer by 2016.[106] It is equally absurd to allow regimes in countries such as Saudi Arabia and Kuwait to engage in price-enhancing cartel behavior while they rely on our military umbrella for their survival.[107]

FOURTH, we should decide that the Strategic Petroleum Reserve should be filled, and its capacity and holdings expanded against the possibility of a supply disruption.[108] It is not a tool susceptible to use as a price-smoothing device, even though Congress has now decided that the President must stop adding to our stockpile in the apparent belief that some government bureaucrats—or even former oil men now located in the White House and in the Naval Observatory—are skilled speculators and can time inflows and outflows from the reserve to affect oil prices. Even such a sophisticated observer as Larry Summers is calling for "reform of Strategic Petroleum Reserve Policy to encourage swaps at times when the market is indicating short supply."[109] Unless that means that any time prices rise, the government's traders should start intervening, which I doubt, it must mean that Professor Summers believes that government officials are capable of successful in-and-out trading in a market in which hardened professionals, disciplined by the fact that they are risking their own money, often come a cropper.

We need the oil in the SPRO in order to reduce the constraints that now exist on our foreign policy towards such as Iran, which can threaten temporary supply interruptions should we do anything they find unpleasant. Remember: much of the world's oil passes through the Strait of Hormuz, twenty-one miles wide at its narrowest point, with the Iranian island of Abu Musa near its entrance, and the Iranian Revolutionary Guard in residence. And a simulation called "Oil Shockwave" has shown that our economy is vulnerable to even a small supply interruption.[110] Yes, there is a danger that private-sector inventories will decline as the size of the strategic reserve increases, but we can't let the perfect be the enemy of the good. Of course, it might make more sense to give oil companies an incentive to hold larger reserves than they ordinarily would for commercial reasons, but there is no possibility that Congress will be willing to work out such an arrangement. After all, after criticizing "big oil" for charging extortionate prices and earning windfall profits, Congress does not see itself in a position to offer "tax breaks" to those same companies to induce them to maintain higher levels of inventory, even though such a policy would be in the national interest.

Italian oil group, has discovered a large tar sands deposit in the Republic of Congo, and similar but larger reserves exist in Venezuela's Orinoco belt. *Financial Times*, May 20, 2008. Those countries are not friendly to us, but if their reserves are developed they add to the international pool from which we draw, and the technologies developed will be transferable.

[105] "Conoco Refinery Expansion Is Set Back," *The Wall Street Journal*, June 9, 2008.

[106] *The Wall Street Journal*, May 29, 2008.

[107] Both countries also prevent U.S. companies from investing in their countries; Kuwait's parliament refuses even to sanction long-term operating services contracts. *Financial Times*, May 21, 2008.

[108] The SPRO holds 701 million barrels, from which 4.4 million barrels per day can be pumped.

[109] Lawrence Summers, "What we can do at this dangerous moment," *Financial Times*, June 30, 2008.

[110] Oil ShockWave is a scenario exercise developed by Securing America's Future Energy (SAFE) and the National Commission on Energy Policy: "In this half-day exercise top former government officials take part in a series of Principals meetings of the Cabinet over a seven-month period in order to advise the President on how to respond to a series of events that affect world oil supplies. The simulation is set six months into the future to provide distance from current events." http://www.secureenergy.org/shockwave_overview.php.

FIFTH, the Environmental Protection Agency should immediately issue waivers to permit a reduction in the mandated nine billion gallons of renewable fuels that are supposed to be blended into gasoline in 2008. That would reduce the harm being caused by the rapid ramp-up in corn-based ethanol production.[111]

SIXTH, we should change the techniques being used to encourage conservation and new technologies. Mandated fuel-efficiency standards are inefficient; the same is true of proposals to limit the production of automobiles to flexible-fuel vehicles.[112] Taxes set to incorporate externalities in the prices consumers face are efficient. Such tax-inclusive prices would include the social costs of consuming energy, with the result that consumers, faced with the full costs of their choices, will consume less. But it would not be good policy to increase the flow of funds into the Treasury, so it is necessary to find some way of diverting these revenues from the Treasury. That can be accomplished by reducing payroll taxes dollar-for-dollar with increases in energy taxes. The net result would be to internalize costs such as environmental degradation resulting from, say, CO_2 emissions, and the defense of supply routes by taxing "bads," and to reduce the taxes on "goods," in this case jobs.

SEVENTH, we need to move energy policy from the Department of Energy to the Pentagon so that policy is made as part of national security planning. Access to energy supplies is crucial to national security. No one understands this better than Vladimir Putin, who has managed Russia's natural gas sales to Western Europe so as to enable him to threaten governments there and in Russia's near-abroad with supply cut-offs if they go too far in disagreeing with him and his KGB colleagues. Writes Robert Kagan, "Europe now depends more on Russia for its supply of energy than on the Middle East.… Russian leaders know this gives them the means to compel European acquiescence to Russian behavior."[113] To enhance its power Russia has also launched a program to purchase foreign energy assets[114] that Alexei Miller, CEO of Gazprom, says will make his company "not just a major company in the world, but the most influential in the energy business."[115]

NATO has found Russia's new energy clout, which French President Nicolas Sarkozy notes Russia is willing to use with "a certain brutality,"[116] sufficiently worrying to use its meeting in Riga last November to claim a role in formulating European energy policy.[117] To view Gazprom or any Russian energy company as anything other than instruments of Russian foreign policy is to be naive in the extreme.[118] Or desperate for new energy supplies—the situation in which Italy finds itself after decades of barring nuclear and coal-based power plants, and which prompted it to sign deals with Russia's Lukoil, worth about $3.65 billion, to bring Russian gas to Italy.[119] The U.S. is close to being in as dangerous a position as Western Europe, with the likes of Señor Chávez astride our supplies, and the Arabs well aware that our fear that they will unsheathe their "oil weapon" has significant effect on our foreign policy flexibility.

EIGHTH, we need to come to grips with the fact that in the future, coal-fired power plants will continue to

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[111] Texas has already applied for a 50 percent waiver, citing high grain prices caused by the ethanol mandate. "US food producers urge ethanol rethink," *Financial Times*, June 20, 2008.

[112] Robert McFarlane, President Reagan's national security adviser, has this and other such items on his list of policies needed if we are to gain energy independence. See his "Don't Give Up on Energy Independence," *The Wall Street Journal*, May 7, 2008.

[113] Robert Kagan, *The Return of History and the End of Dreams* (London: Atlantic Books, 2008), 14. For a report on how Putin has out-maneuvered the European Union's effort to gain some independence from Russia's pipeline network, see "Energy Race: Russia Outflanks EU's Pipeline Plan," *The Wall Street Journal*, June 16, 2008.

[114] Marshall I. Goldman, *Petrostate: Putin, Power, and the New Russia* (Oxford: Oxford University Press, 2008), 204.

[115] "Gazprom chief sets out vision as biggest power in world energy," *Financial Times*, June 27, 2008.

[116] Cited by Kagan, *Return of History,* 23.

[117] Fox, "Energy Security," (see fn. 103 above), 5.

[118] For a handy summary of the structure of Gazprom and its relationship to the Russian government see "As Gazprom Goes, So Goes Russia," *The New York Times*, May 11, 2008.

[119] "Italy, Russia Energy Firms Strike Deals," *The Wall Street Journal*, June 25, 2008.

China plans to build over 500 new coal-fired plants in the next half-dozen years, and India over 200. So much for reducing carbon emissions … We need to come to grips with the fact that in the future, coal-fired power plants will continue to supply much of our electricity.

supply much of our electricity.[120] Ian Miller, chief executive of Doosan Babcock, a manufacturer of power equipment, points out, "There are enormous quantities of coal around the world, enough for 300 to 400 years of consumption, and it is a fuel that is easily transported. It is a fuel with a lot of flexibility."[121]

Unfortunately, we here in America are likely to deny ourselves efficient access to this resource unless we strike a more reasonable balance between environmental and other policy goals. America has ample supplies of coal, estimated by the Department of Energy to be one quarter of the world's total. Additional resources are "available from stable, friendly countries such as Australia, and the technology is well understood."[122]

Other countries are heading towards increased reliance on coal. Britain is planning a new coal plant in Kent, despite objections from opponents who want new plants deferred until clean-coal technology is developed;[123] Italy plans to increase its reliance on coal-powered generation from 14 percent to 33 percent over the next five years, during which about 50 new coal-fired stations will be put into operation in Europe.[124] But the really big players are China and India. China plans to build over 500 new coal-fired plants in the next half-dozen years, and India over 200. So much for reducing carbon emissions. And so much for any hope that the price of coal will remain immune to price pressures in markets for other fossil fuels: government economists expect coal prices to rise in response to increased worldwide demand and the falling dollar.[125]

The prospects for expanding coal use in the United States, however, are not bright. Of the 151 coal-fired plants in the planning stages in 2007, 59 were either refused licenses by the states or quietly abandoned. Another 50 are being contested in the courts[126] by environmental groups that proclaim, "We hope to clog up the system," using what the press describes as "any bureaucratic or legal means necessary."[127] They have strong support from James Hansen, director of NASA's Goddard Institute, an early advocate of measures to stop global warming, and a hero to congressional Democrats. Hansen wants to phase out coal use by 2030 except in plants that could capture the carbon dioxide.[128] Congressman Henry Waxman plans to introduce a bill calling for a moratorium on the construction of coal-fired power stations. Given the government's abandonment of a carbon-sequestration demonstration plant in Illinois, the probability that the Democrats will control Congress in 2009, and the certainty that the next resident of the White House, whoever that turns out to be, is convinced that global

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[120] About half of U.S. power is generated from coal; the electric power industry accounts for about 90 percent of U.S. coal consumption. National Petroleum Council, *Hard Truths* (see fn. 95 above), 64.
[121] Rebecca Bream, "Old favourite sees price rise," *Financial Times*, June 30, 2008.
[122] *The Economist*, April 5, 2008.
[123] "Backing for coal-fired plant attacked as reckless," *The Times*, June 5, 2008.
[124] "Europe Turns to Coal Again…," *The New York Times*, April 23, 2008.
[125] "Increasing Costs in Electric Markets," report by the Office of Enforcement, Federal Energy Regulatory Commission (June 19, 2008), 4.
[126] Lester R. Brown, "U.S. Moving Toward Ban on New Coal-Fired Power Plants," Earth Policy Institute, February 14, 2008. www.earth-policy.org?Updates/2008/Update70.htm.
[127] Statement by David Bookbinder, chief climate counsel of the Sierra Club, reported in *The Los Angeles Times*, April 14, 2008.
[128] "Burned Up About the Other Fossil Fuel," *The Washington Post*, June 24, 2008.

warming is an existential problem, Waxman might just get his moratorium passed. And if not, there are always the courts to stand in the way of increased use of coal. A state court in Georgia recently revoked a permit issued by the Georgia Department of Natural Resources approving construction of what would be the state's first new coal-fired power plant in twenty years. Judge Thelma Wyatt Cummings Moore ruled that the $2 billion plant cannot be built unless the sponsors limit the plant's carbon dioxide emissions. This, despite the fact that there are as yet no federal standards for such emissions. Environmentalists have announced that they will use the decision, which will be appealed, "to push for an end to conventional coal."[129]

All of this adds up to a program that is unlikely to make optimal use of our ample coal resources in the foreseeable future. The only hope is "clean coal." But that technology still eludes us. Indeed, research into ways of reducing the environmental impact of burning coal has recently come to something of a standstill. Earlier this year Energy Secretary Samuel Bodman scrapped the public-private partnership between the government and the FutureGen Industrial Alliance, a non-profit consortium of twelve U.S. and international energy companies. The partnership had hoped to create a near-zero emissions power plant, but cost over-runs—the magnitude of which is a subject of dispute between the Department of Energy (DOE) and its partners—and alleged political pressure from the Texas congressional delegation, which lost its bid to have the project sited in Texas rather than in Illinois, convinced DOE to redirect its efforts towards carbon capture and storage (CCS) technology, which is far from ready for practical use,[130] "decades away from commercial viability" according to some reports.[131] But work is proceeding. The UK government has announced the next round of its "CCS funding competition" during which four companies will "enter into more detailed discussions concerning technical, commercial, contractual and financial issues with the Government."[132] Vattenfall, a Swedish power company, will soon open a pilot CCS plant in Germany. If it succeeds, and if—and only if—appropriate subsidies are made available, the company will build a full-size plant at an estimated cost of €1 billion to €2 billion ($1.6 billion to $3.2 billion).[133]

No discussion of the possible role of coal in America's energy future would be complete without a mention of the likely effect of some variant of the recently defeated cap-and-trade bill. That system is intended to reduce coal consumption to between 62 percent and 89 percent below what it would otherwise be later in the century, in part by forcing the retirement of existing plants[134] that cannot efficiently be retrofitted with new carbon storage technology[135] —should such technology be developed.

Cap-and-trade is the preferred mechanism of the K Street crowd. Companies would be issued permits to pollute, and would be free to sell or trade those permits. The initial recipients of the permits will be getting windfalls worth billions of dollars. To imagine that the congressmen in a position to dole out these valuable permits will be immune to lobbying pressure, and that the lobbyists will not understand the implicit linkage between their clients' campaign contributions and the allocation of permits, is to ignore the lessons of history. And not-so-ancient history at that. In Europe, governments have proved susceptible to corporate lobbying for permits, and emissions have risen because governments issued more permits than the steel and other industries needed. Hugo Robinson of Open Europe, a London-based research group, reports, "The sheer amount of lobbying creates so much uncertainty about the way these markets operate that

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[129] "Georgia Court Orders Greenhouse-Gas Limits," *The Wall Street Journal*, July 1, 2008, and Matthew Wald, "Georgia Judge Cites Carbon Dioxide in Denying Coal Plant Permit," *The New York Times*, July 1, 2008.
[130] "Energy Secretary Scraps FutureGen Clean Coal Project," Environment News Service, January 31, 2008.
[131] "The Dirty Truth About Clean Coal," *BusinessWeek*, June 30, 2008.
[132] "UK consults on next step for Carbon Capture and Storage," reported by Herbert Smith in its *Energy e-bulletin*, July 4, 2008.
[133] Bream, "Price rise," *Financial Times*, June 30, 2008.
[134] Fred C. Iklé and Lowell Wood, "Oil, Oil, Toil & Trouble," *The National Interest*, Number 93, Jan./Feb. 2008, 19.
[135] "Coal States in Climate-Bill Fight," *The Wall Street Journal*, June 4, 2008.

Our dependence on open shipping lanes demands that we include in military budgets the naval resources that defense of the routes demands. That is a cost of our energy consumption.

nobody is really interested in cleaner technologies in Europe."[136]

Even if the permits are auctioned off, depriving recipients of a windfall, the prospect for an efficient outcome is grim. Bills that are likely to receive congressional approval and the signature of the new President call for the trillions that will be paid for permits to go into a fund, to be used to finance technologies that government bureaucrats decide are likely "winners" in the race to reduce our dependence on foreign oil. Anyone familiar with past programs, most notably the government's aborted Synfuels project of the 1980s,[137] will not be inclined to cheer at turning such large sums over to the government. If there is to be an auction, which McCain opposes in the initial stages of cap-and-trade,[138] the funds should be used to reduce other taxes lest the result be what Senator Bob Corker has called "the mother of all earmarks."[139]

But that is unlikely, given support for the cap-and-trade variant favored by both presidential candidates. Which means that hopes of developing technologies for the efficient and environmentally acceptable use of coal will rest with government bureaucrats, who will control the release of funds and therefore the direction of research.

NINTH, we cannot disassociate our energy condition from our military condition. The hard fact of our dependence on open shipping lanes in the Middle East and around the world demands that we be prepared to defend those routes, and to include in military budgets the aircraft carriers and other naval resources that defense of these routes demands. That is a cost of our energy consumption, and should be reflected in the price consumers confront when they fill their gasoline tanks and warm and cool their homes. Another reason why energy taxes are so badly needed.

I end with a personal note, based on decades of involvement in debates about energy policy. I am rather pessimistic about our ability to develop appropriate policies for securing energy supplies, and for pricing the energy we consume efficiently. In that view I am not alone, witness the following conclusion of a leading analyst of regulatory policy: "Rent-seeking occurs across the wide variety of different fuels.... There is no reason to expect that either energy policy or climate change policy is economically efficient. Indeed, one would expect quite the opposite.... Economic analysis [might] ... help inform policy but, in most cases, it is not likely to be the driving force."[140]

We *won't* tax energy use; we *won't* tax carbon; we *won't* spend money to enable us to utilize our unlimited coal resources; we *won't* use any leverage against cartelists;[141] we *won't* open all of our own promising areas to drilling; we *won't* use the Strategic Petroleum Reserve as we should; we *won't* help our own oil companies to compete with state-owned entities; we *won't* pressure oil-rich countries to allow American firms to develop new resources. We *will* hurl billions at rich corn-growing Iowans (voters in the nation's first cau-

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[136] "The Trouble With Markets for Carbon," *The New York Times*, June 20, 2008.

[137] For a description of the project see Paul Rothberg, "Synthetic Fuels Corporation and National Synfuels Policy," Issues Brief Number IB81139, The Library of Congress, Congressional Research Service, Major Issues System, 08/17/81, updated 02/18/83. See also Hefner, "Age of Energy Gases" (see fn. 22 above), 172: "The $10 billion ($25 billion in 2007 dollars) spent for the 'Synfuel' coal to natural gas program was a complete bust and waste of taxpayer money."

[138] "The Trouble With Markets for Carbon," *The New York Times*, June 20, 2008.

[139] "Uncorking Energy Supplies," *The Weekly Standard*, June 30, 2008, 11.

[140] Hahn, "Ethanol: Law, Economics, and Politics" (fn. 65 above), 32.

[141] In my "Breaking the Oil Cartel," *American Outlook* 2, no. 2 (Hudson Institute, September 2000), I suggested bringing an antitrust action

Economics says let high prices curtail demand and increase supply; politics says lower prices, stimulate demand, and constrain supplies. Enter rationing, overt or covert.

cuses) and other farmers; we *will* enact a cap-and-trade system that experience has shown is an invitation to fraud and wide-spread corruption of the political process by lobbyists and other seekers after advantage; we *will* pretend that nuclear power is economically viable in the absence of sensible carbon pricing; we *will* hurl billions at technologies that can contribute only marginally to meeting our future energy needs.

Those who say that there is little that can be done to provide immediate relief from out energy condition should be reminded of two things. First, the longest journey begins with the first step: long-term investments can begin only if restrictions on their initiation are removed and market-based incentives allowed their full sway. Second, there are useful steps we can take tomorrow, in addition to lifting bans on augmenting domestic supplies:

• We could end the tariff on imported ethanol

• We could end restrictions that require different blends of gasoline be used in different markets

• We could impose a tax on carbon, recycling the proceeds through the Social Security system

• We could pool our subsidy funds and let private entrepreneurs bid for them, the winners being those most willing to put private equity at risk (have most skin in the game, to use Wall Street jargon) relative to subsidies requested

• We could open the Yucca Mountain Repository

• We could subsidize our private-sector oil companies competing for supplies with state-supported entities so that an important externality, our national security, is taken into account.

These measures are consistent with an energy policy that would have the overriding goal of making markets work better.

But my guess is that we will do none of the above. In the end, constraints on supply will drive prices to levels that are politically unsustainable. Politicians, seeing an opportunity to expand their power massively at the expense of their leading competitor, "the market," will pounce. Economics says let high prices curtail demand and increase supply; politics says lower prices, stimulate demand, and constrain supplies. Enter rationing, overt or covert.

So we certainly cannot reasonably expect any *solution* to the energy problem, which may in any event be insoluble; whether we can *cope with* the energy condition in which we find ourselves, a process that may in the end be made easier by the sheer size and monumental flexibility of our economy, and by technologies produced by our world-admired entrepreneurs, is an

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against the OPEC cartel, a view that is now fashionable in Congress and in some academic circles. See Darren Bush, Harry First, and John J. Flynn, "Sue OPEC," *Los Angeles Times*, June 19, 2008, in which the authors argue that OPEC's activities are "commercial, not governmental," and should therefore be subjected to the same antitrust scrutiny as "foreign businesses and individuals [that] have long been subject to U.S. antitrust laws.…" But I have been persuaded that such a policy would be damaging to U.S. interests by the following communication from John Shenefield, assistant attorney general in charge of the antitrust division during the Carter administration. Shenefield decided against bringing an action because "the potential cost of chaos in the energy markets, the loss of basing rights in the Middle East, the impact on intelligence cooperation, the damage to bilateral relations with every member state—all of these and more would need to be considered. The president should make the final decision after a thorough interdepartmental vetting of the relevant issues.… It's the same sort of decision Reagan made when he ordered the shut-down of the Laker grand jury [looking into complaints that the low-fare carrier had been put out of business by monopolizing behavior by BA] at Thatcher's request when he was asking her for support for the deployment of Pershings and cruise missiles."

open question. The price mechanism may prove powerful enough to overcome the obstacles created by the political process: reduce the growth in demand for energy, and increase its supply, while encouraging innovators to develop the gadgetry that will wean us off of oil. If not, a significant reduction in the standard of living we might otherwise enjoy is in our future. ■

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