

# ***MIT Joint Program on the Science and Policy of Global Change***



## **Future United States Energy Security Concerns**

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# **Future United States Energy Security Concerns\***

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## **Introduction**

America shares with other nations the desire for affordable energy to fuel our economies and improve our private lives, without harming the environment. Achieving this ideal will require technical ingenuity -- finding pathways that minimize substantial public and private economic costs -- and, the political determination and discipline to stick with the long-term programs needed to develop new patterns of energy production and use.

Unfortunately, for the foreseeable future, however, we will not have inexhaustible supply of inexpensive, clean energy. For at least the next half-century, the United States and its allies will continue to rely on fossil fuels and a substantial and growing amount of oil imports. In this paper I will address the connection between energy and security, especially how the energy security issues that we face in the future differ from those we faced in the past.

## **Justification for concern about energy security**

Why do we make a connection between energy and national security that we do not make for other sectors of the economy, for example, electronics, autos, agriculture, or metals? There are three reasons. First, without energy, the economy can neither function nor grow. In the short run, substitution is difficult because of reliance on a large, fixed infrastructure. Second, energy

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resources – especially oil – are not distributed uniformly around the globe; and importing countries are dependent on the behavior of the oil rich nations. Middle Eastern countries – bound together as OPEC – are particularly worrisome, because they are in an unstable part of the world that is not necessarily friendly to the United States or its allies. Third, one energy technology – nuclear energy – demands special attention because misuse of the nuclear fuel cycle can provide material suitable for making bombs.

These three issues—dependence (economic consequences of energy imports), vulnerability (to politically motivated energy supply disruption), and proliferation—are the overarching reasons for special concern about energy security. Specific energy security issues are framed by geopolitical realities.

### **Three energy security issues of the 1970s.**

During the Cold war, the Soviet Union posed a threat to Middle Eastern oil with its considerable military forces poised across the Caucasus from Middle East oil fields. This threat influenced our military planning and set the public impression of the U.S. vulnerability to interruption of our Middle East oil supply.

Our dependence on Middle East oil imports was vividly demonstrated by the 1973-74 and 1978-79 OPEC oil embargos that caused sharp increases in the real price of oil and gas lines at home.

Finally, India detonated a nuclear device<sup>1</sup> in 1974 with plutonium diverted from a Canadian supplied heavy water (CANDU) reactor that was ostensibly operated for non-military purposes.

During the next two decades – 1970 to 1990 – the U.S. cooperating with the International Energy Agency<sup>2</sup> and the Organization for Economic Co-

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<sup>1</sup> Prior to 1974, only the United States, the Soviet Union, the United Kingdom, France, and China had exploded a nuclear device. India was the first non-nuclear weapon state to do so.

operation and Development<sup>3</sup> (OECD) coped with these energy security issues; by design and good fortune the results were positive:

The Soviet Union did not invade or otherwise seriously influence the oil producing Middle East states. With the fall of the Soviet Union in 1991, this energy security problem went away.

The world economy survived the two OPEC oil embargos of the seventies. The interruptions were painful but relatively short. They defined the limits of OPEC's monopoly power. Here there were important lessons learned: Oil producing countries must offer their oil to the market, because their economies and politics require the income on which they are dependent. Even radical Muslim regimes such as Iran<sup>4</sup> have recognized this necessity. Also, consumers reduce demand during a supply disruption in response to higher prices, allowing the market to allocate available supply to alleviate shortages. Inventories (public and private) and sharing agreements for available supply ease the short-term pain of a supply shortfall.<sup>5</sup> Finally, non-OPEC oil producers respond to higher prices by increasing production thereby limiting OPEC's clout in any long-term reduction.

The 1974 explosion by India of a nuclear device alerted the world to the dangers of nuclear proliferation from commercial nuclear power. This event motivated the Carter administration to lead an international effort to reduce

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<sup>2</sup>The International Energy Agency (IEA) was established in November 1974 in response to the oil crisis as an autonomous intergovernmental entity within the Organization for Economic Cooperation and Development (OECD) to ensure the energy security of industrialized nations.

<sup>3</sup>The OECD members are 30 democratic countries, excluding China and Russia.

<sup>4</sup> Following the Shah's overthrow in 1978, the new radical regime announced it would not produce oil beyond the amount needed for internal consumption, about 500,000 b/d. In fact, over time, Iranian production rose to about 4 million b/d, somewhat under the peak production of the Shah's period, about 2.5 million b/d is exported.

<sup>5</sup> The 1974 IEA agreement requires countries to hold oil stocks equivalent of at least 90 days of net imports of the previous calendar year and to release oil stocks, restrain demand, switch to other fuels, increase domestic production, and, if necessary, share available oil, in the event of an oil supply disruption of seven per cent or more to the IEA or individual countries.

proliferation risks. After prolonged diplomatic negotiations, many governments accepted the need to withdraw from existing agreements that threatened to increase proliferation; the United States renounced reprocessing of commercial spent fuel; a German-Brazilian enrichment deal was cancelled; and French discussions about reprocessing in several countries were stopped.

The United States should take considerable satisfaction from the success of its leadership role in forging a wide consensus on proliferation issues during this period.

By 1980, the essential policy instruments needed to achieve a reasonable degree of energy security were known and agreed; these were to:

- Deregulate energy prices. Let energy prices move to world market clearing levels; do not artificially keep energy prices low.
- Maintain adequate stocks of oil<sup>6</sup> and participate in international agreements to “share” shortages.
- Encourage measures that improve energy efficiency and moderate demand.
- Encourage exploration and production of non-OPEC oil. Today this means encouraging oil development in Russia and the Caspian Sea region.<sup>7</sup>
- Encourage renewable energy sources, such as wind, geothermal, and solar energy that avoid progressively scarcer and vulnerable sources of oil.
- Reduce the proliferation risks from commercial nuclear power.

### **Energy security considerations today**

The policy principles learned in the 1980s and 1990s remain valid today, although the particular energy concerns have changed. These policy

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<sup>6</sup> In 1978, the United States adopted a one billion barrel Strategic Petroleum Reserve in addition to industry stocks.

<sup>7</sup> Non-OPEC oil production has increased relative to OPEC oil production from 1977 to the present. OPEC oil production today at 30 million b/d is about the level in 1977. During this period, non-OPEC oil production increased from 28.8 million b/d to 42.6 million b/d.

principles should be adequate to meet energy security issues going forward. This needs to be said, however, because these principles are sometimes blurred by policy scoundrels who advance security as justification for special interests and for taxpayer support for an energy project or program.

There are many examples of this promotion: subsidies for synthetic fuels, for renewable technologies, for gasohol to benefit farmers, and for domestic oil and gas producers. Advocates advance the security connection on the general argument that imported oil might be avoided without confronting technical uncertainties or the comparative cost of the alternative technology. Considerations of genuine security risks can get pushed aside. We should resist the political temptation to exploit energy security to serve special interests and keep our eye on legitimate geopolitical energy security concerns.

There are new dimensions to energy security. Today, the basis of much of our concern about energy security is that oil dependence indirectly influences the policies and politics of importing countries such as Japan, Germany, and France to favor oil-possessing nations of the Middle East that are unfriendly to the United States. Some suggest U.S. interest in counteracting the indirect influence caused by dependence as the sinister explanation of all our Middle Eastern policies – from the invasion of Iraq to our attitude toward the Arab/Israeli conflict. I do not believe this to be true. To be sure, it is galling to give a significant fortune through oil purchases to countries such as Iran, Iraq, and Libya that are not allies or important trading partners. Worse yet, some of these oil dollars may fund terrorist activities. We want to avoid spending money abroad for oil that carries the possibility of supply interruption, but we also want to avoid how potentially unfriendly states might use some of the oil revenues.

However, it is naive to believe that use of our economic and military can easily or quickly bring democracy to the Middle East and that this would reduce our dependence on foreign oil. Although we do not like this

dependence, we have learned to live with it and will live with dependence for the foreseeable future. So, if as some suggest, the Saudi royal family may be overthrown, OECD countries will still need to import vast quantities of Saudi oil – that is the bad news. The good news is that the successor regime will still need the oil export revenue. If through some miracle, the successor regime became a Jeffersonian democracy, the price we would pay for Saudi oil would likely not decline, but we might well be happier about how the oil revenue was spent.

### **Energy security issues going forward**

As in the past, today's energy security issues reflect the underlying concern with vulnerability, proliferation, and dependence. The specific issues reflect today's, not yesterday's, geopolitical realities. I offer five issues:

- Vulnerability of the energy infrastructure to terrorist attack;
- The urgent need to reduce proliferation risks of the commercial nuclear fuel cycle;
- The growing dependence of the United States on imported natural gas;
- The growing dependence of developing countries, especially China and India, on imported oil;
- The emergence of global warming and the accompanying need to control of carbon emissions as a contributor to north-south tension.

The last two issues are consequences of the major growth in energy consumption that the non-industrialized world is expected to experience over the next several decades. The U.S. Department of Energy's Energy Information Administration (EIA) projects<sup>8</sup> 2.7% annual energy growth for the developing world during the period 2001 to 2025 (3.5% and 3.2% for China and India, respectively), in contrast to 1.2% growth rate for the developed world (1.4% for the United States). By 2025 the energy

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<sup>8</sup> EIA *International Energy Outlook (2004)*, Table A1, page 163.



consumption of the industrialized and non-industrialized world will be comparable; in 1990, the non-industrialized world consumed about one-half the amount of energy of the industrialized world. The increased competition for available supply as non-industrialized nations enter in world energy markets, will inevitably give rise to energy security issues, of the kind discussed below.

***The risk of catastrophic terrorism.*** Over the next decades, we should plan for additional terrorist attacks, if for no other reason than the inability of our enemies to compete with us in conventional military terms. Energy infrastructures have always been vulnerable to attack. Pipelines, tankers, refineries, and power plants are soft fixed targets for terrorist attack. What is new is the emergence of a few well-financed, motivated, and talented terrorist organizations that have worldwide reach, e.g., Al Qaeda, Hamas, Hezbollah, and the Palestinian Islamic Jihad. These terrorist groups can strike energy targets whenever they choose to do so. Energy targets are especially attractive to terrorists, because they can cause significant economic loss and disruption without risking the level of response to an attack that takes large number of human lives. The information and communications systems that control our energy infrastructure (power plants, transmission lines, pipelines) are increasingly vulnerable to cyber attack.

Protecting our energy infrastructure and lessening the consequences of such attacks, should they occur, is one of the priority concerns of the new Department of Homeland Security. Managing this security risk will require new mechanisms of cooperation between government and the energy industry and substantial expenditures on protective measures.

***Controlling proliferation risks of expanded used of commercial nuclear power.*** Along with terrorism, combating the proliferation of weapons of mass destruction is a priority foreign policy aim of the United States. One critical aspect of this effort is to assure that commercial nuclear power does

not become, purposefully or inadvertently, a source of nuclear materials, technology, or know-how to enable a nation or sub-national group to acquire a nuclear weapon. The 1978 Non-proliferation Treaty, inspections by the International Atomic Energy Agency (IAEA), and control of nuclear technology transfer, are important measures designed to slow the spread of nuclear weapons capability.

However, the proliferation challenge will increase during the next few decades, because a significant growth in electricity consumption is expected, especially in the emerging economies – China, India, Indonesia, Mexico, and Brazil. Nuclear power could supply a significant fraction of this electricity growth, although nuclear has several hurdles to overcome for this to happen: high capital cost, lack of effective waste management, and uncertain safety. Nevertheless, it is important to assure that as commercial nuclear power expands, critical fuel cycle facilities – providing enrichment and reprocessing – that are most subject to misuse do not spread around the world. Several proposals have recently been advanced for extending the nonproliferation regime to assure that new fuel cycle facilities do not become a source of weapons material.<sup>9</sup> It is interesting that restricting dangerous fuel cycle operations is one of the few foreign policy issues that have bipartisan support. But the continuing controversy about Iran’s nuclear program and the recent decision of Brazil to operate a new enrichment facility indicate that proliferation will remain high on the energy security agenda.

***United States dependence on natural gas imports.*** Most experts believe that North America, notably the United States and Mexico, will join Japan and Europe as major importers of natural gas, shipped either as liquefied natural gas (LNG) or liquid products produced from natural gas, e.g.

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<sup>9</sup> One example is “Making the world safe for nuclear energy,” John Deutch, Arnold Kanter, Ernest Moniz, Daniel Poneman, to be published *Survival* fall (2004).

methanol. The price of this marginal source of natural gas, perhaps \$4.50 per thousand cubic feet, will determine the market price of natural gas in North America. The cost of landed LNG, rather than the production cost of domestic gas in Texas or the Gulf of Mexico will set the market price of natural gas. So experts expect that we will import natural gas in significant quantities, leading to concerns about security of supply and dependence similar to those we have experienced with oil imports.

The final two energy security issues I discuss arise from the significant growth in energy demand anticipated from the developing world. On the one hand, this growth is welcome because it signals greater prosperity and individual quality of life for a previously neglected population. On the other hand, this additional demand for and utilization of fossil resources inevitably brings opportunity for conflict.

***Growing developing country demand for oil.*** The growing demand for imports of oil and gas by developing countries, especially China and India, will lead to greater worldwide dependence on and competition for imported oil. The EIA projects<sup>10</sup> that total world oil production will grow from 77 million barrels per day (b/d) in 2001 to 121 million b/d in 2025. In 2001, industrialized and non-industrialized countries imported 36.5 million b/d and 19.7 million b/d respectively. These levels are projected to grow to 49.9 million b/d for industrialized and 39.5 million b/d for non-industrialized countries by 2025. U.S. imports will increase from 11.5 million barrels per day (b/d) in 2002 to 20.7 million b/d in 2025.<sup>11</sup>

China's growing oil (and natural gas) import dependence illustrates the security concerns that will arise. Chinese oil imports are anticipated to grow from about 3 million b/d to 9.4 million b/d between 2001 and 2025.<sup>12</sup> China will become a very significant player in world oil (and natural gas)

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<sup>10</sup> U.S. Department of Energy, Energy Information Agency, *International Energy Outlook (2004)*; Table 8.

<sup>11</sup> EIA *International Energy Outlook (2004)* Table A4, page 167

<sup>12</sup> EIA Country analysis brief: China <http://www.eia.doe.gov/emeu/cabs/china.html>

markets. Inevitably this will increase tensions between China and developed nations in Asia – notably Japan, Korea, and Taiwan – who are our allies and also need access to increasing amounts of imported oil and gas. So it is quite likely that oil and gas imports will become an important factor in U.S.-China relations. While energy issues by themselves will not cause armed conflict in the region (as might, for example, Taiwan), energy issues will increase the strain in an already fragile relationship.

A dark prospect connects two energy security issues: China's growing dependence on foreign oil and proliferation. It is not inconceivable that China might covertly assist Saudi Arabia to move towards a nuclear weapon capability (China has sold Saudi Arabia CSS-4 medium range ballistic missiles in the past) in exchange for preferential access to oil supply.

An important objective of U.S. foreign policy should be to avoid strategic conflict between China and the United States. Energy security is another factor that complicates the relationship and reinforces the view that diligent efforts will be required to avoid conflict.

***The role of carbon.*** I believe that over the next decade, it is likely but not certain, that carbon (and other greenhouse gas emissions) will become the most important issue on the world energy agenda, because of the perceived irreversible and adverse consequences of global warming. The debate over proposed solutions for constraining carbon emissions is sure to lead to significant political North-South tensions. Consequently, carbon control is likely to become a seriously complicating factor in energy security, especially in our diplomatic relationships .

There is impressive scientific agreement by experts on global warming and climate change that continued growth in emissions of greenhouse gases will lead to concentrations in the atmosphere twice pre-industrial levels and will cause a significant temperature rise. There is less confidence in the timing, magnitude, and distribution of the accompanying temperature rise, and there is no political consensus (after the collapse of Kyoto accord),

about how the world might plan to adjust to carbon constraints. Moreover, the Kyoto protocol does not settle the most contentious policy dilemma of how to constrain the growing carbon emissions of developing countries. These countries that are going to be the greatest sources of carbon emissions in the next decade or so, because of the pace of their economic growth, may have neither the means nor the will to constrain their emissions.

China again offers a salient example of the potential for controversy regarding the growth of carbon emissions. China's rapidly growing electricity sector<sup>13</sup> and energy use indicates an inevitable increase in carbon emissions. For the period 2001 to 2005, EIA projects<sup>14</sup> growth of coal use by China of 3.9%; during the same period the industrialized world is projected to have less than 1% growth in coal use. By 2025, China will be using as much coal as all the industrialized countries. China has a projected growth rate of 3.3% in carbon dioxide emissions, compared to 1.2% for the industrialized world in an unconstrained 'business as usual' scenario.

It is likely that the world will seek to place constraints on carbon emissions. The Kyoto mechanism of target reductions is, from the viewpoint of economic efficiency, very much second best compared to a carbon tax or a cap and trade system. But whatever the mechanism, it will not end the need for China, India, and other rapidly developing economies to use fossil fuels. Inevitably, global warming will become a central issue on the international agenda and endless trouble will come from the zealous pushing the laggards. The developed world's effort to discourage fossil fuel use, especially coal, in the name of global warming and nuclear power in the name of proliferation will be seen as hypocritical by the developing world and resolution of the differences will not come easily or without cost.

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<sup>13</sup> Chinese electricity consumption is projected to grow at an annual rate of 8%.

<sup>14</sup> EIA *International Energy Outlook (2004)* Table A6, page 169;

## **Conclusion**

Philip II, the sixteenth century Spanish king, was the first ruler with dominions that spread around the world. He complained endlessly about the number and complexity of foreign matters that required his attention.<sup>15</sup> This will certainly be true for our next President. Energy security is only one of many security matters that will require presidential attention and leadership. Understandably, energy security will not receive the priority of fighting terrorism or combating the spread of weapons of mass destruction (although as we have seen, there is a connection). I have argued that the policy principles and instruments are in place to deal with the important and complicated upcoming issues. However, the success of our energy security policy requires a focus on genuine geo-political issues and disciplined attention by policy makers.

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<sup>15</sup> See Geoffrey Parker, *The grand strategy of Philip II*, Yale University Press (New Haven) 1998.

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