Energy (In)Security in the 21st Century

*By John R. Brodman**

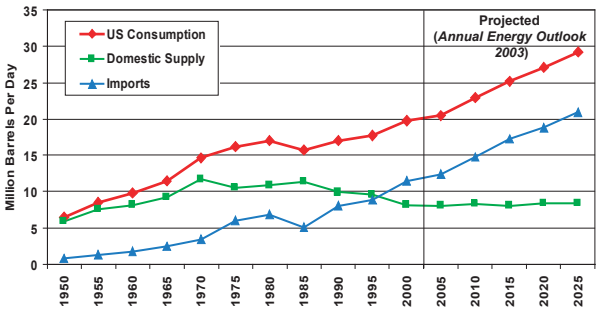
Energy security, like beauty, is in the eye of the beholder. What is it? How do you define it or measure it? How much is enough? While the answers to these questions depend in large measure on your perspective, our energy security concerns are a dominant factor in U.S. energy policy for many reasons:

1. Many of our long-standing concerns about energy security stemming from developments in the Middle East are still with us;
2. Energy security is often an entry point or rationale for government interference or involvement in energy markets;
3. There are many new challenges in the area of energy security itself, some stemming predominantly from our growing concerns with terrorism;
4. Oil producing countries, old and new, large and small, are increasingly facing new challenges and new threats, often from internal sources of instability, which can have an impact on our energy security; and
5. There is concern that our growing dependence on oil and gas imports may have considerable influence on our foreign policy.

Growing reliance on imported oil was a major consideration in the development of the President's National Energy Policy (NEP), which was issued in May 2001. The NEP recognizes that U.S. dependence on imported oil has serious economic and national security implications. Just let me run through a few basic charts to define the problem and set the stage for our discussion:

Chart one shows the evolution of U.S. dependence on imported oil. Consumption is rising with income and population growth, and domestic production is at best trying to hold its own.

Chart 1
Increasing U.S. Petroleum Consumption



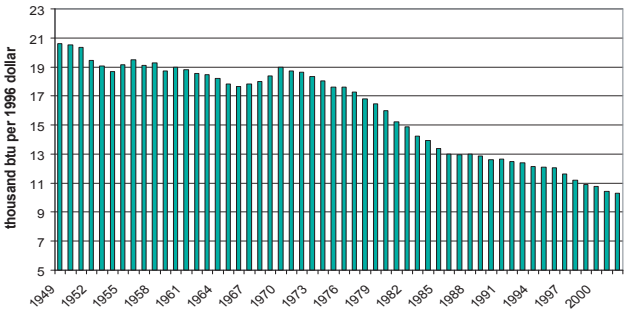
Our dependence on imports has gone from nil in 1950 to close to 50% in the late 70's, declining after that as a result of Alaska and high prices, then rising to 50% in the late 90's and on up since then. It is expected to keep rising through the forecast period to close to 70% by 2025.

We have experienced major supply disruptions in the past, including the OPEC production cuts in '99 and 2000, and their impacts on oil prices. And, of course, it is the impact of the oil price increases that has the negative effects on our economy and our economic security.

The coincident timing of the oil price increases and periods of economic recession in the U.S. is noteworthy. The period of stable prices up to 1973 was marked by surplus capacity and price controls, and an underrealization by OPEC of its market power.

Chart 2 shows that the U.S. economy is becoming more resilient. In the last 50 years, we have reduced the amount of energy required to produce a $1.00 of GDP by half. Now we know that this gross measure disguises a lot of different factors at work, but it is, nevertheless, significant. Oil consumption per unit of GDP, however has only declined about half as much as total energy per unit of GDP.

Chart 2
U.S. Energy Consumption per Dollar of GDP



Now let me turn for a moment to recent developments in the market.

The Organization of Petroleum Exporting Countries (OPEC) continues to employ a production policy that has resulted in low inventories and relatively high world oil prices. In late 2001, the combination of reaction to September 11 and slowing economic activity sent oil prices for a brief period below $20 (for New York Mercantile Exchange West Texas Intermediate). OPEC cut its official production quota in both September 2001 (by 1 million barrels per day) and January 2002 (by 1.5 million bpd) in an effort to support its price goals. The latter cut was taken in conjunction with cooperation from key non-OPEC producers such as Russia, Norway, and Mexico. The market responded to the cuts in production, with oil prices rising in the first few months of 2002. Crude oil prices spent most of 2002 in a range of $26 to $30 a barrel.

The strike in Venezuela in December 2002 and the resulting cut in Venezuela's exports hit the United States particularly hard. The U.S. had typically imported 1.5-2.0 million bpd of oil from Venezuela. Oil imported from Venezuela is also considered "short-haul," in that there is a 5-7 day transit time to the United States, compared to 40-45 days for crude

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oil shipped from the Middle East. Crude oil prices began rising with the December strike in Venezuela, then were pushed higher in early 2003 by the uncertainties created by the situation in Venezuela, strikes and upcoming elections in Nigeria, and the looming possible conflict with Iraq. Crude oil prices peaked in the upper $30's in late February and early March. With Saudi Arabia and other producers taking action to ensure supply, prices fell back below $30 a barrel in the days leading up to the March 20 start of the war in Iraq.

Oil prices have fluctuated around $30 since the end of the war in Iraq. OPEC took action in late April 2003 to get its production down from its pre-war heights (raising its official quota, but with the goal of reducing "real" production), in order to make room in the market for the return of Iraqi oil. OPEC then surprised the world oil market at its September 24, 2003, meeting by taking a more "proactive" role in managing the market, by looking ahead and anticipating the expected weakness in the second quarter of 2004, and by cutting production by 900,000 bpd.

U.S. crude oil and primary product inventories have been running lower than normal for some time. They never fully recovered from the loss of Venezuelan supplies. U.S. crude oil inventories spent most of 2003 below the low-end of the average range designated by the Energy Information Administration. For several weeks in February and March of 2003, crude oil inventories hovered near the 270 million barrel level, designated by EIA as "lower operational inventory." Gasoline and distillate inventories have joined crude in remaining below normal for most of 2003. Low inventories have been a factor in supporting oil prices.

One of the current causes of volatility in this market place has been the uncertainty about the pace of recovery of Iraqi oil output. It has fluctuated between almost nothing and 3 mmbd in a very short period of time.

OPEC has had a difficult time coping with this and the other uncertainties, but we feel that they have done a better job in the last few years of anticipating weakness in the marketplace and cutting output, than they have done at anticipating tightness in the market and increasing production. We wish they were more symmetrical in their behavior towards the market. They, on the other hand, feel that we don't appreciate everything they are doing to keep the market supplied. But at least we're talking.

Energy Security Policy

What have we learned from all this? In the last thirty years, developments in the world oil market dominated our energy security concerns, and we have been impacted by six serious interruptions of supply:

- The Arab oil embargo
- The Iranian revolution
- The Iran/Iraq war
- The Iraqi invasion of Kuwait, the first Gulf war, and the subsequent embargo
- The recent strikes in Venezuela, and to a lesser extent in Nigeria, and
- Regime change in Iraq

But even this is not the whole story. By some counts there has been one major disruption every three years in the last half century, and four in the last two years alone. The point made by many observers is that oil supply disruptions while unpredictable, are inevitable.

We have devoted a great deal of effort over the years to analyzing the differences between import dependence on the one hand, and vulnerability to supply disruptions on the other. In the short term, we learned to allow market forces to allocate supplies, and to depend on the use of excess production capacity and strategic reserves to augment supplies if required. We learned that oil is a fungible commodity, and that the marginal barrels are the determining factor in the marketplace. In the longer term, we strove to improve our energy security through diversity, in both the types of energy we use and in the sources of supply, and through efficiency gains, which limit the economic damages of price shocks on our economy.

We developed over time, with varying degrees of success, a flexible, or organic energy security policy that was based on a changing mix or combination of policies. This combination of policies is a mix of:

- Reliance on market forces
- Opening markets to free trade and investment in energy resources
- Energy efficiency
- Diversification of supplies, both in the types of energy we use and in their sources
- Science and technology, research and development for the long term
- Good relations with the rest of the world
- A strong military to protect our interests, and
- Strategic petroleum reserves, both as a deterrent and as a supply of last resort.

At the heart of this flexible, multiple policy approach was and is a desire to promote and protect resilient international oil and energy markets through the application of sustained policies that transcend political partisanship and stand the test of time. The goal was to reduce the threat and incidence of disruption, and to mitigate the effects of a disruption if it did occur.

We have also come to realize that there is no magic or "silver bullet" policy prescription for our energy security concerns. It isn't Russia, it isn't West Africa, it isn't ANWR, it isn't renewables, and it isn't restrictions on consumption. Its not nuclear, or hydrogen. Rather, it is all of them taken together that give us a measure of protection. Higher excise taxes on petroleum may make economic sense, but they are politically improbable.

U.S. energy policy is founded on the belief that open markets ensure optimal production and supply of energy. But government policy also recognizes that open markets largely reflect the situation here and now, and that the government has a role to play in assuring that technologies are developed to ensure the most efficient use of energy, to facilitate the use of alternative fuels and energy carriers such as hydrogen, fusion and nuclear, and to develop new, secure energy supplies

to meet the energy needs of today and the future.

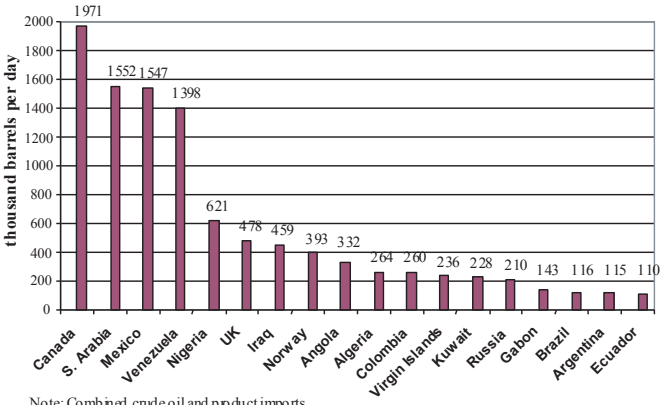
Also, from an energy security point of view, U.S. government energy policy has a strong role to play in assuring our energy supplies represent a diverse set of energy resources from a diverse set of energy suppliers. The National Energy Plan, issued in May 2001, embodies these fundamental principles and recommends actions that will help achieve these objectives. The Plan also recognizes that the United States cannot address its energy concerns alone, and that our energy security is intricately linked to international markets as a result of our increasing dependence on external sources of supply.

U.S. energy policy recognizes these new international challenges, and the National Energy Plan calls for strengthening our global alliances through such important mechanisms as our existing bilateral relationships with key countries and regions around the world, and through our participation in multilateral energy institutions such as the IEA and IEF. Security of supply is the driving force behind our policy engagement on energy issues with most countries.

In this context, I would like to say a few words about diversity. Thirty years ago oil was produced in commercial quantities in just over 60 countries around the world, and the share of the top ten producers in overall world supply was greater than 80 percent. Today, oil is being produced in commercial quantities in over 90 countries, and the share of the top ten producers has fallen to about 60 percent. While some of this increase in the number of producers can be attributed to the breakup of the former USSR into separate countries, there are also many new producers, in Africa, Latin America and elsewhere.

Chart 3 shows the current makeup of U.S. imported oil supplies, with the position of the top four, Saudi Arabia, Mexico, Canada, and Venezuela, being followed by a diverse set of suppliers from all over the globe.

Chart 3
U.S. Petroleum Imports by Source
2002



Note: Combined crude oil and product imports
Source: Energy Information Agency *Petroleum Supply Annual*

Russia, the Caspian, the Western Hemisphere and Africa are important sources of our imports of oil and natural gas, and that their importance is likely to grow in the future. They are likely to be an important source of additional supplies for decades to come. But their proven reserves and production will never allow them to replace the Middle East in importance to world energy markets. Eventually, our dependence on the Middle East will grow again. This is what I call the geologic facts of life.

Now what does that mean for energy security? In the first place, we have always favored a strategy that promotes a diversity of supplies. In this sense, this new diversity is generally viewed as a good thing. While you can argue that more oil from diverse sources might raise the risk of disruption simply because there are more producers, you can also argue that the disruption will likely be smaller in the first place, and more likely to be offset by compensating increases from the other sources.

While our policy of supply diversity has been successful to some degree, the development of many frontier oil provinces carries with it its own set of political, economic and security risks. Our policy of diversifying supplies relies on commercial investment in energy projects. We don't tell our companies where to invest or where to buy oil. It is up to them, and there are a considerable number of obstacles to realizing this commercial investment, directly related to economic, political, and security risks.

An unfavorable business climate may keep needed resources locked away from development for a long time.

The emerging threats to energy security in many new producing countries and regions, and indeed, as recent developments in Venezuela and Nigeria have demonstrated, in older producing regions as well, are somewhat different than those we have faced in the past. As a result, they may also require new policy responses. In the past, supply disruptions came from sovereign political decisions, revolutions, conventional wars, and acts of nature. Today there are increased risks from non-traditional, and often internal, sources of conflict, such as:

- Corruption and a lack of transparency
- Governance issues and human rights
- Federal, state, and local jurisdictional disputes
- Ethnic/religious conflicts
- Border and territorial disputes
- Energy sector revenue management issues, poverty and the distribution of income
- Lack of managerial capacity
- Political instability
- Environmental issues
- Lack of "rule of law" and dispute settlement procedures, unfavorable business climate

These threats to energy security, clearly recognized in the National Energy Plan, may not always lend themselves to conventional security solutions. These new threats call for a continuation (and possible enhancement) of the balanced and sustained engagement with the oil-producing countries that we have been pursuing, to help them manage and utilize their revenues in a way that promotes political stability and sustainable economic growth. For this reason, it may be that sustainable development is the real frontier battleground for energy security in the 21st century. The lack of good governance is also a fertile breeding ground for terrorism, and we

may have not yet grasped the full implications of terrorism for the energy sector.

Speaking rhetorically, it may be reasonable to ask why and whether oil consumers or developers should be responsible for promoting sustainable economic development in many of the new oil producing countries? I would respond that we may need to be more engaged on sustainable development issues with energy producers in order to minimize many of these new, internal threats to stability, and to promote, protect and defend our own security of supply, and our own security in commercial energy and trade relationships.

Let me now turn to the Strategic Petroleum Reserve. Figure 1 shows the evolution of our SPR policy. The EPCA authorized the establishment of an SPR up to 1 billion barrels. There are currently about 640 million barrels in the reserve, or an amount equivalent to 60 days of our net oil imports. We are currently filling the SPR with federal royalty oil at a rate of about 150,000 bpd, and we expect to reach capacity of 700 million barrels by the middle of 2005.

Figure 1
SPR Development History

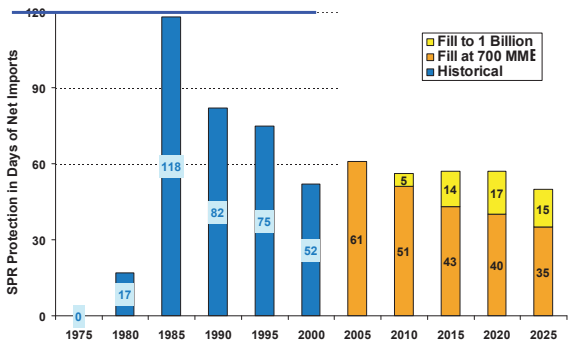
1975 *Energy Policy and Conservation Act (EPCA)* authorizes establishment of an SPR up to **1 Billion Barrels**.
1976 DOE submitted Plan to **establish a 500 MMB** Reserve based on 1974 and 1975 levels.
1978 DOE submitted Plan Amendment to Congress to **increase Reserve to 750 MMB.**
1990 Congress directed DOE to **submit a Plan for expansion** of the Reserve to 1 Billion Barrels.
1991 DOE **submitted a Report** to Congress **on Candidate Sites** for the 1 Billion Barrel Reserve.
1991 DOE notified Congress it **would not expand** the Reserve **until** fill of the currently available capacity **approached a need** for further capacity development.
1992 DOE **completed the development** of the Reserve **to 750 MMB**.
2001 President Bush **directed** the Reserve **to be filled to Capacity** using Federal Royalty Oil.
2001 The U.S. House unanimously passed a Resolution urging the Bush Administration **to increase the Reserve to 1 Billion Barrels.**

Chart 4 shows that the days of import coverage afforded by the 700 million barrels is expected to decline after 2005 as imports continue to rise. The light increment on the chart shows the additional increment of protection we would get if the size of the SPR were increased from 700 million to 1 billion barrels.

Now on SPR use policy, which is much more controversial, there are probably as many as many views about the right way to manage strategic petroleum reserves in this room, as there are people. For example, during this recent period marked by the strike in Venezuela and the lead up to the war with Iraq, some people believe that the mere existence of strategic reserves, coupled with an active debate in IEA Member Country capitals about how and when to use them, was enough to incentive, in addition to the already high prices, to push producers to raise output to keep the market adequately supplied, and to put a lid on speculative activity. They argue that this prevented governments from actually having to intervene.

Then, there are others who feel that the strike in Venezuela was a tailor made text book case for a use of the U.S. SPR. We lost 2 mmbd of short haul oil, and any replacement oil from Africa or the Mideast would take weeks to get to our ports. Why not use the SPR as a bridge mechanism to fill this temporary gap? In the end, we felt that with the possibility of war, it would be better to get spare production on line asap, so it would already be available by the time an even more serious loss might occur.

Chart 4
Projected SPR Protection



In addition, European Union energy ministers recently debated a proposal that would have them using their reserves in a more proactive, interventionist way to deal with market fluctuations, and promote a managed stability in the oil market. Fortunately, they decided against it.

I think there is a danger here. The more governments use their strategic reserves to intervene in the market, the easier it becomes to justify more intervention. It is a slippery slope in policy terms, and once you start down this road it is hard to stop. Also, frequent use of strategic reserves will remove the incentive for private stockholding activity, and reduce the incentive for producers like Saudi Arabia to hold spare production capacity. Where would we be without spare production capacity? I would argue in the spirit of newfound cooperation between producers and consumers, that reliance on the market and use of this spare production capacity is our best and first line of defense.

Spare production capacity has varied widely in the past 30 years. Spare production capacity costs money, and there will only be an incentive for producers to maintain spare capacity in the future if they are able to use it from time to time to take advantage of market fluctuations and earn some extra bucks.

Today spare capacity is around 2.5 mmbd, but most of that is in one country: Saudi Arabia.

The other challenge surrounding strategic reserves continues to be the need to integrate the new strategic reserve policies of China, India and other large consumers into the mainstream.

China

Any discussion of energy security today would be incomplete without acknowledging the potential growth of

demand for oil in China, India and other large consumers. If motor vehicle ownership in China and several other countries even begins to approach the levels of the developed world, spare production capacity as it exists today could disappear quickly, and capacity could be hard pressed to keep up with growing demand. China's demand is growing at a rate of 15% per year, and its imports are growing at a rate close to 30%. China's imports could rise to 4-5 mmbd by 2010 and to a level similar to our own by 2030.

Is this a potential threat to our energy security? It could be in some circumstances. It could also signal the beginning of a new era of much higher oil prices that may or may not be coupled with the imposition of controls or limits on the growth of oil consumption in some countries. In any event, it bears watching.

Finally, the newfound cooperation between producers and consumers shows how much improved communication can prevent misunderstanding and help to keep the market adequately supplied. While improved cooperation between producers and consumers is generally regarded as a good thing, it does have the potential of going full circle and raising a whole new series of transparency concerns.

Wholesale Electricity Procurement Strategies *(continued from page 12)*

eration of managing certain spot market risks that may arise during unexpected unit and transmission line outages.

[18] Structured products are available in bilateral markets, but their prices are not widely reported.

19 We use Natsource, Platts, and TrueQuote as sources for forward contract pricing data. These data were collected during Spring 2003 such that our analyses look forward starting with June 2003.

[20] Because wholesale products are most typically sold as blocks of on-peak power, in many instances when hedging is carried out there is a need to sell back excess quantities.

[21] In our analysis for the PJM region, the forward contract data available were for forward terms that were shorter. Therefore, for this analysis, we assumed two one-year forward contract purchases for the yearly minimum on-peak and off-peak demands for 2003 and 2004.

[22] We used various utilities' load profile data and total consumer counts to develop hourly demand profiles that were then combined with forecasted demands used in the modeling to determine expected hourly demands. We did not make any adjustments for potential impacts of consumer migration during the study period, but instead assumed that all demand must be served regardless of how individual entities end up serving it. It is straightforward to take this same analysis and examine how serving various combinations of consumer classes will affect projected costs.

[23] Developing estimates of these costs will vary by state and region. In some instances, these services will be purchased from the incumbent investor-owned utility in the region, while in other instances, they can be purchased from the wholesale market. Our capacity cost estimates assume the use of longer-term contractual instruments for the provision for capacity.

[24] In Tables 2A-B and 3 we show that monthly and annual cost estimates would fall into a range that is associated with the underlying fundamental assumptions used for the price forecast. For example, the low side value would be associated with lower load or fuel prices when compared to a base case that uses extant market information at the time the forecasts are developed, while the high side would represent higher fuel prices, load or unit outages.

[25] The price forecasts include many hours where prices are above $100/MWh, but all forecasted prices assume that supplies are offered to the energy market based on generating unit marginal operating costs.

[26] This underscores the point that hedges are protective and do not generally lower costs, but instead stabilize costs.

[27] In these example analyses, we purchase these firm hedges for the months of July-September and January-February.

[28] This pictorial representation provides the intuition behind identifying the amount of hedge to purchase. In our analysis, we minimized the relative difference between each of the lines and the base case when selecting the hedge amount.

[29] Variations among consumer classes are similar to those observed in the limited hedging approach.

[30] The opposite approach—purchasing puts if more firm on-peak hedge positions were taken than described—is equally feasible, although we did not use this approach.

[31] We used call option pricing data obtained from Trueqoute.com as a source of call option prices.

[32] Additional analyses would look at different combinations of hedges to see if a particular approach that combines call options and firm monthly purchases is more cost effective.