

My aim in structuring the energy portion of the symposium program has been to provide you about a half day's worth of briefings on the topic. Ms. Phyllis Martin from the Department of Energy (DOE) began the process by explaining who uses energy, the types of energy they use, what are the future projections, and the

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*The moderator is Mr. Duncan Brown, the Director of the Strategic Assessments Office (SAO) at JHU/APL. The SAO conducts broad ranging analyses and assessments of national security strategy, policy, and technology trends. Mr. Brown has also served on the Navy staff in the Pentagon as the Science Advisor to the Deputy Chief of Naval Operations, in the Pacific as the Science Advisor to the Commander in Chief Pacific Fleet, and in the Pentagon as the Director for Submarine Technology. Mr. Brown also headed the Hydrodynamics Branch at the Naval Undersea Warfare Center (NUWC) in Newport, Rhode Island. The Branch was responsible for investigating drag and noise reduction techniques for submersibles using both numerical simulations as well as test models in its own tow tanks and on ranges. Mr. Brown holds a M.S. degree from Johns Hopkins University in technical management, a M.S. degree in ocean engineering from the University of Rhode Island, and a B.S. degree in engineering science from Hofstra University. Mr. Brown's professional education includes postgraduate work in National Security Studies at Georgetown. He was also a Fellow in MIT's Seminar XXI Foreign Politics and International Relations in the National Interest Program and Harvard's Program for Senior Executives in National and International Security. Mr. Brown has received three Navy Superior Civilian Service Awards, a Naval Award of Merit, the Naval Undersea Warfare Center Science Award, and several JHU/APL Special Achievement Awards. Mr. Brown is a Board Member of the Baltimore Chapter of the American Society of Mechanical Engineers, a member of the Board of Trustees for the Baltimore Council on Foreign Affairs, and is involved with the Boy Scouts of America.*

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potential impact of climate change. So that is the first one. The second set of briefings will come during this particular panel, and what I am going to do is tell you how we use oil, simply just to educate everybody because there are a lot of misconceptions out there.

Jeff Werling from the University of Maryland will then talk to you about the economic impacts associated with a major disruption in world oil supplies. That assessment was part of a study we did a couple of years ago that looked at how the United States and the world might deal with such a major disruption in oil supply of as much as 5 or 10 million barrels a day. [1] Then, John Simpson from the General Services Administration (GSA), and formerly of the Rocky Mountain Institute, will discuss how the military uses energy and ways it can save, as well as ways the United States could substantially reduce the amount of oil that it uses.

The dinner speaker will be Professor Nate Lewis from Caltech, who will discuss how the world produces energy, how the world uses energy, and what can reasonably be done to change our sources of energy from nonrenewable ones to renewable ones. Then, first Rear Admiral Philip Cullom will describe his role as Director, Task Force Energy and what it means for the Navy. So that is the line-up for the energy portion of the program.

What I would like to do at this point is give you a brief tutorial just to make sure we are all on the same page in terms of who produces oil and who uses oil and for what purposes. So in terms of world oil production, the three biggest producers, as you can see from Figure 1, are Saudi Arabia, Russia, and the United States. Now a lot of people do not realize that the United States is actually the third largest producer of oil on the planet.

The next question is who are the consumers? Well, the answer is that the United States dwarfs everybody else (Figure 2). The total world usage is between 78 and 80 million barrels a day. It was a little bit higher back in 2007/2008, but because of the global economic crisis it has dropped somewhat. But basically in rough numbers, the United States consumes about 20 million barrels a day or one quarter of the world's oil production. China is second at

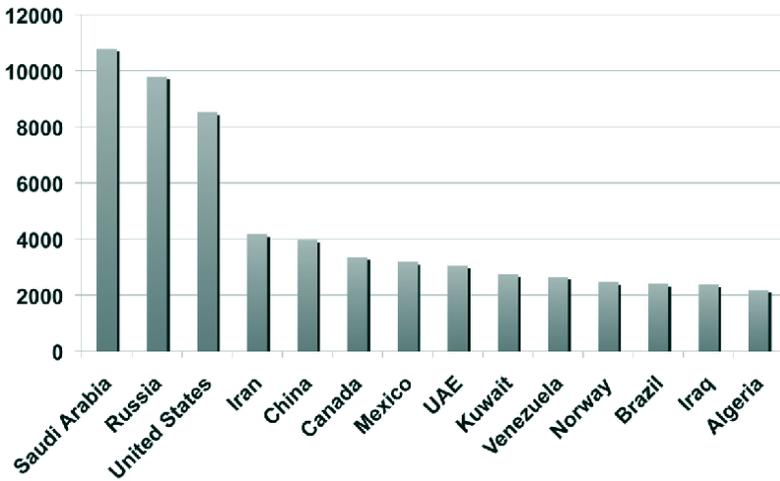


Figure 1. World Oil Production (MBD-2008)

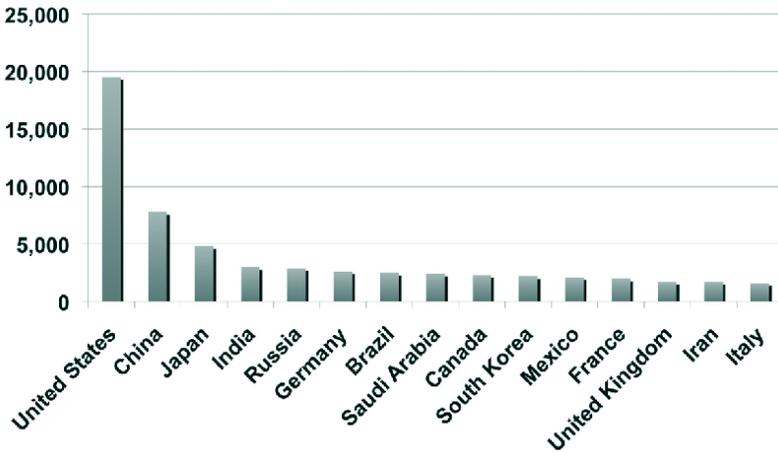


Figure 2. World Oil Consumption (MBD-2008)

about 7.5 million barrels a day, of which roughly half is imported. In other words, China produces half of the petroleum it uses and imports the other half. Japan is a distant third, basically consuming just less than five million barrels a day.

In terms of imports (Figure 3), I told you that the United States consumes about 20 million barrels a day, a little bit less than that now, again, because of the global economic crisis, and imports about two thirds of that, or about 12 million barrels a day. Japan imports basically 100%; China imports about half.

In terms of oil exports, who are the major exporters? The two major exporters far and above everybody else are Saudi Arabia and Russia (Figure 4). In terms of worldwide oil flows, basically

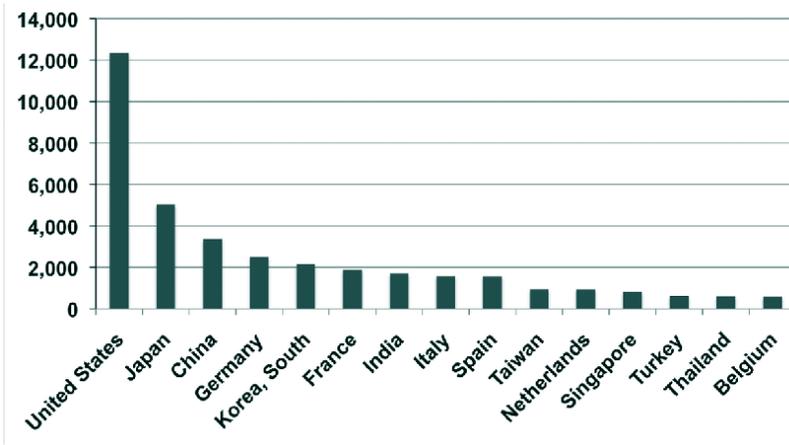


Figure 3. World Oil Imports (MBD-2008)

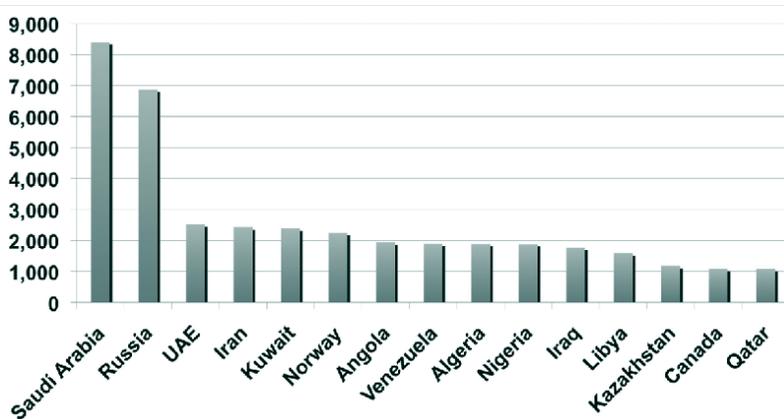


Figure 4. World Oil Exports (MBD-2008)

what you can see from Figure 5 is that much of what is produced in the Middle East goes three places: It goes to Europe, it goes to portions of the Middle East, and the rest of goes to Asia.

Figure 5 shows where oil from the Middle East is going. Only a small portion of it is coming to the United States. But then, of course, when you look at the United States, you see that we have done a pretty good job of diversifying our imports. We get a lot of our oil from the Atlantic basin; I will show you the specific numbers.

In terms of shipment routes, and one of the things that the Navy has to be concerned about is a lot of what is shown in Figure 6, much of the world's oil flows through choke points such as straits or canals. You can see them listed in Figure 6. The two big ones are the Straits of Hormuz and the Malacca Straits.

In the case of the Malacca Straits, there was a study done a few years ago by CNA that asked, "What happens if the Straits of Malacca get blocked?" [2] The answer is you just ship things around Australia. Doing so adds 1% to 2% to the cost, but it is not the end of the world. That is not true for the Straits of Hormuz. If you close the Straits of Hormuz, there is no easy way to get the oil out of the Persian Gulf, and that becomes a major problem. Now how one would actually close the Straits of Hormuz is



Figure 5. World Oil Flows

a whole different issue, and we could have a debate on whether it is even possible.

As you know, there is a lot of rhetoric out there that says we import most of our oil from the Middle East. It is not true. You can see the numbers in Figure 7. We are basically importing most of our



Figure 6. Major Oil Shipment Routes

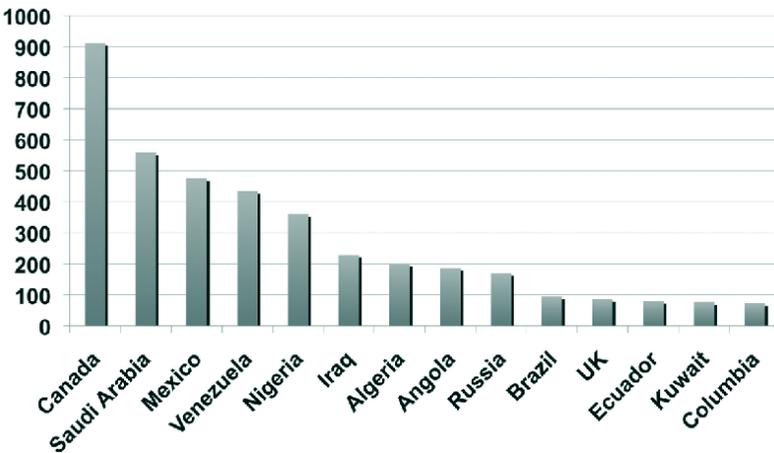


Figure 7. Major U.S. Oil Imports by Country of Origin

oil from Canada and Saudi Arabia and then Mexico, Venezuela, and Nigeria.

In terms of how the United States uses energy in total, not just oil but in total, whether it be for transportation or whether it be for electricity production or industrial uses, you can see the numbers for 2008 in Figure 8. I think these numbers have changed a little bit, but coal is up a little bit and oil is down a little bit, but they are pretty close, within a few percentage points.

That is basically how we use energy in total. Then the question is: How do we use oil? The reason I mention this is because when you hear somebody say, “Well, we’re going to produce nuclear power plants and that’s going to free us of Middle East oil,” you say, “Well, wait a minute. How does that work?” What you have to look at is how do we use oil. Basically, in this country at least, two thirds of oil is actually used for transportation (Figure 9).

The other one third is basically used for industrial processes and maybe one percentage is used to make electricity. Building nuclear power plants does not help you get off of oil. It is just that simple. Within the transportation sector, one third of the fuel is used by heavy trucks and aircraft and the other two thirds is used to fuel cars, light trucks, and sport utility vehicles (SUVs). Thus, if you really want to reduce your consumption of oil, you need to go after the transportation sector.

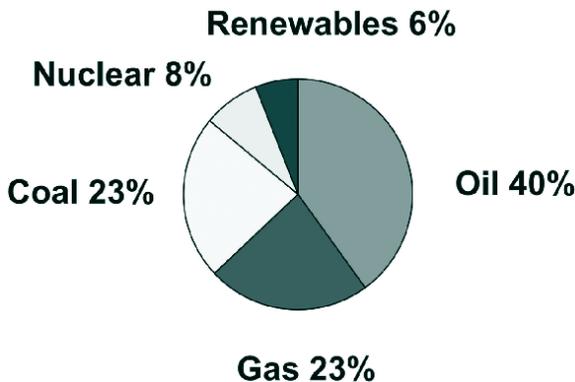
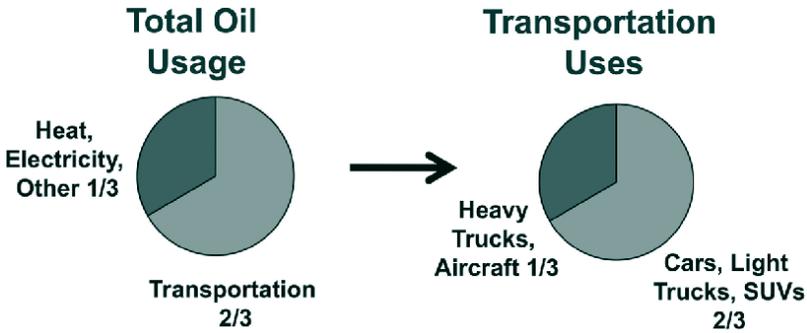


Figure 8. Sources of U.S. Energy Consumption



**Figure 9. U.S. Oil Use**

If you want to go after the biggest chunk of the transportation sector, that turns out to be cars, light trucks, and SUVs. Several years ago we looked at what we could do to reduce energy consumption or switch to renewables. Although I cannot present the data because it is proprietary to one of the automobile manufacturers, I can tell you that we looked at what you could do to reduce energy use in cars, SUVs, and light trucks. As it turns out, there are ideas on the shelf right now that, if implemented, could probably increase average miles per gallon from 25 up to about 45. Implementing these changes would add a few thousand dollars to the cost of a car, but consumers do not yet seem willing to pay that price.

## REFERENCES

1. Duncan Brown, Energy Workshop, The Johns Hopkins University Applied Physics Laboratory, Oct 2008.
2. John H. Noer, *Chokepoints: Maritime Economic Concerns in Southeast Asia*, National Defense University, 1996.