3.3 ECONOMIC IMPACTS OF GLOBAL PETROLEUM SUPPLY SHOCKS

Dr. Jeffrey Werling

Hopefully, by the end of my talk, you will have a better idea of how we get the consumer interested in buying cars that get 40–45 miles per gallon. I think there is a definite way to do that. I am going to cover two topics. First, I will identify the likely economic impacts of a big supply shock. As part of that, I will also look at some of factors that you might want to have considered ahead of time to mitigate the effects of such a shock.

For my second topic, I will address ways that we can reduce our vulnerability to energy shocks, maybe not in the next 5 years, but over the next few decades. As we will see, many of the things that we can do to reduce vulnerability are really the same things that we can do to reduce our vulnerability to climate change, or at least reduce our carbon emissions.

Let's begin by looking at energy consumption per capita (Figure 1). We see that our friends in Canada are a little higher than the United States. That is because they have more energy than that United States, but the United States is right behind them and just ahead of Russia. So on a per-capita basis, the United States is the

Dr. Jeffrey Werling is Executive Director of Inforum. In addition to managing the day-to-day activity at Inforum, he serves as principal investigator for special projects applying Inforum modeling systems. He has completed recent studies on the economic implications of energy policy, immigration, exchange rate fluctuations, and port disruptions due to terrorist strikes. Dr. Werling also teaches an undergraduate course in economic development. Previously, he held positions as an international and industry economist with the National Electrical Manufacturers Association (NEMA), the Manufacturers Alliance (MAPI), and the WEFA Group (now Global Insight). He received a Ph.D. in economics from the University of Maryland in 1992.

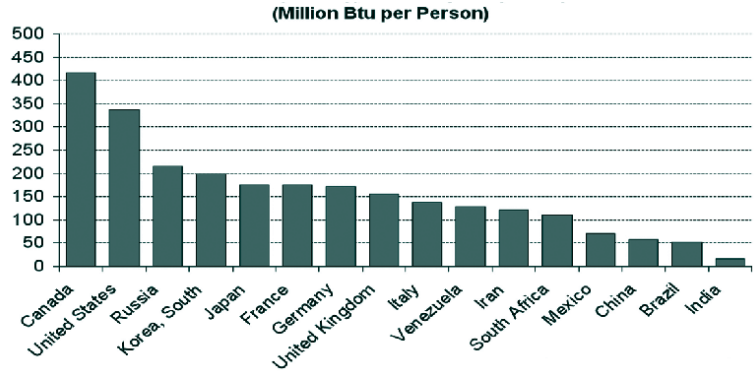

Figure 1. Total Primary Energy Consumption per Capita

king of energy consumption, per se. Per-capita U.S. consumption is little more than twice that of France, Germany, or Japan.

On a per GDP basis, South Africa, Russia, and China rank highest, but the United States right up there as well (Figure 2). Using this measure, the United States is about 30% higher than the typical European country. So you get the feeling that there probably is room for conservation. What happens if we do have a big oil supply shock? To find out, several years ago we did a study in which we considered two different levels of abrupt shock.

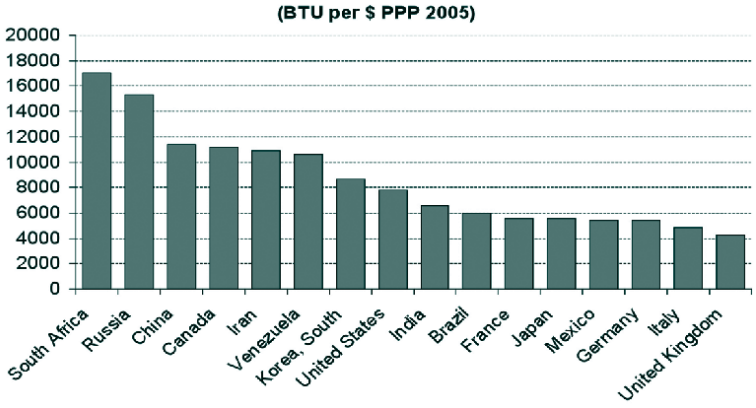

Figure 2. Total Primary Energy Consumption per Dollar of GDP

The first one assumed a 4.8 million barrel per day shortfall over a 3-month period. At the time, that was about 5% of global consumption. The second case was double that at 9.6 million barrels per day, or a bit more than 10% of global consumption.

So, what do you want to think about ahead of time? A number of important factors are listed below.

- Size matters: 9.6 million barrels per day is more than twice 4.8 million barrels per day.
- Duration: 6 months is twice 3 months.
- Current supply/demand equation: Is there unused capacity?
- What is the underlying casue? Military/civil strife will tend to have a negative *psychological* impact.
- Did the shock appear unexpectedly or were there warnings?
- Perceptions: Is price spike temporary or permananet?

One thing is that size matters in the sense that it is a nonlinear relationship. In fact, a 10% disruption is a lot worse than a 5% disruption—the larger the disruption, the greater the economic impact. Duration matters as well. We could live with a big disruption for a week, but once it turns into a month or 3 months or longer, well, then the disruption is much, much greater. Another of the things you want to think about is the underlying cause. If it is a natural disaster then people are more likely to roll with the punch. But if it is a terrorist event, then people are worried about what will happen next.

Uncertainty really contributes to the disruption. What inherent things do we have in the economy that can help us roll with this shock? The most important thing we have is the inherent resilience that comes from simply having a vibrant market economy, which will effectively allow us to ration gasoline and oil according to price.

As consumers, we do not like to hear that. You are going to see some pretty ugly numbers when it comes to the price of gasoline, especially in the case of a big oil shock, but, you have got to admit, it is going to change our behavior. To some extent, we

are going to be able to ration oil and send it to the highest value thing. So that is a case of inherent resilience that helps us minimize the disruption of the impact. We can also have what we call adaptive resilience in planning ahead, things such as the strategic petroleum reserve.

But the rest of us think we could get a piece of that as well. That is one of the things that we do as a nation, to plan ahead. There are other things we can do. One of the things we did when we ran this scenario is examine which ports would be apt to lose supply. If, for example, you cut off the Los Angeles port from supply, there are not really any good ways to get petroleum to the West Coast. Those are some of the things you need to think about ahead of time.

In the event of such a crisis, national leaders could just say, "Well, we understand that the price of gas is very high" but a little moral suasion, as we economists like to call it, can go a long way. The President getting up and saying, "Everyone should be thinking about carpooling and other efficiency efforts," can be effective in the short term. Monetary and fiscal policy, on the other hand, are likely to have only minimal impacts in the case of a supply shock like this; there is not a lot you can do in that sense. Some of the important policy considerations are listed here:

- Monetary policy will focus on financial market liquidity and stabilization. Given higher inflation, a direct reaction to lower growth will be secondary.
- Fiscal policy effectiveness and options would be very limited.
- Some non-price rationing might be necessary, especially with large shocks. Examples: Reducing work/school days to 4 per week. Even–odd?
- Fuel subsidies, taxes, and surcharges
- Strategic Petroleum Reserve and associated logistics
- Distribution decisions: High prices hit vulnerable groups. Something to think about ahead of time.
- Planning can be important; it adds to resilience.

However, non-price rationing might be more helpful. Government could institute a 4-day schedule for schools or for nonessential government services. Doing such things can take a lot of demand out of the system. But you have got to think about such options ahead of time.

Although our supplies of oil are quite diversified, it is important to remember that petroleum is sold on a world market. Although the United States does not import much oil from the Middle East, a disruption in supplies from that region will force the Europeans, who do consume a lot of Middle Eastern oil, to bid on oil from Nigeria or Venezuela with the likely effect of increasing the price. Just because we rely on a diversified set of sources does not mean that we are insulated from a shock that might happen in Saudi Arabia or Iran. We are still going to have to buy out oil out of the same bucket.

Given that, why do the Chinese go all around the world trying to secure their supplies of oil? Why do they make those deals? Well, frankly, a lot of economists scratch their head and say, "We have no idea why they do that." Does it really make sense for anyone to go to war over oil supplies? Before answering that, you need to remember that it is always going to be cheaper to buy oil than go to war. Moreover, that applies no matter what the price is; at least that is what I would like to convince the Chinese. But that is what you have got to be thinking about. The shocks that we are talking about—a 5% reduction in global supply—are big shocks, so large in fact that promises of a dedicated supply are likely to go by the boards.

As I said, we examined a basic disruption of 4.8 million barrels a day or 5.5% of supply for 6 months, and then we doubled that. In both cases, we assumed that the Strategic Petroleum Reserve and other strategic supplies around the world would be tapped. In the first case, the price of oil rose to $175 per barrel; in the second, it rose to $289 per barrel during the second month following the disruption. After that, the prices start coming down as governments tap reserves and people start to learn how to live with sky-high oil prices.

Both scenarios assume that at the end of 6 months we are back at baseline levels of supply. The shock is sudden but transient shock and thus does not last forever. But it does deliver an economic punch; the possible economic damage includes the following:

1. Income/Demand Effects—Higher prices are an Organization of Petroleum Exporting Countries (OPEC) "tax" on consumers, firms, and government as revenue flows abroad. Demand reduced for everything else.

2. Supply or Substitution Effects—Rising energy costs reduce profits or increase prices, especially for energy-intensive items (transportation/tourism, chemicals, etc.). Demand for these is reduced.

3. Policy Effects—Higher energy prices spark inflationary pressure and causes monetary authorities to tighten credit conditions. Government energy bills rise substantially, crimping fiscal stimulus.

4. Effects on Confidence and Financial Market Psychology—Hurt consumer and investor confidence. As security prices and household wealth decline, the economy is weakened. Effects would be especially strong if cause is a major geopolitical event, such as a terrorist attack.

Whenever we have big price shocks in oil, as we did in 2008, the main source of damage to the national economy comes from what I call the OPEC tax. It is just the fact that that extra amount that we pay for oil is going outside our borders. It is a drain on our income.

Because I am spending more money on gasoline, I am not spending that money on a vacation or a new washing machine or something else. Thus, demand for those other things is reduced. In addition, industry, especially those industries like chemicals, which are highly dependent on the price of oil, are hit with a huge increase in the cost of raw materials or transportation. They lose their competitiveness and their workers begin to lose their jobs.

You are also going to see adjustments in monetary policy by the Federal Reserve. On one hand they want to increase demand, but on the other hand they have to worry about inflation. So, they are unlikely to do much at all. Fiscal policy will also be limited because it will not have time to react.

One of the biggest dangers in such crises is a reduction in confidence, which affects people's willingness to spend. If it is a natural disaster that takes out a big facility for a while, people can say, "Well, you know, these things happen." However, if it is a terrorist incident, it is a confidence hit that not only affects consumer spending, but probably the financial markets as well.

Figure 3 shows the estimated price rise for the two cases. The dashed line shows the projection for the smaller shock. It peaks at about $4.5 per gallon. I could probably live with that. In the case of the larger shock, price peaks at $6 per gallon. In that case, I guarantee you that I am going to do something different.

That money is coming right out of the consumer's pocket, right out of the U.S. government's pocket. The Navy is still going to have to operate, regardless of the price of oil. So that is a big chunk of their operations budget.

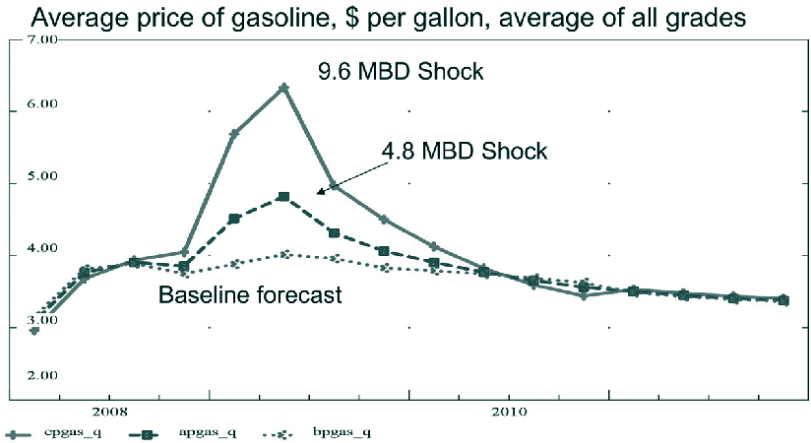

Figure 3. Oil Supply Shocks: Estimate Increase in Price of Gasoline

The GDP impacts in Figure 4 are noted by the dashed and solid lines. Both show a significant decrease. In fact, in both cases a recession occurs in the first quarter, followed by a period of zero growth and then healing or recovery. As you might expect, the bigger shock sends us into a bigger recession. You lose 3% of GDP in the first quarter and another 4% later on. Eventually, we get a little uptake, but we are still way below the baseline 2 years later.

Employment is also hit very hard; we are losing, by the third quarter of this thing, 5 or 6 million jobs per quarter (Figure 5). In addition, inflation would go up to 4% for a while and then recede a bit. Eventually, things return to normal.

So, as you can see, our dependence on foreign oil does make us vulnerable. The way to get away from that is to diversify, not just our sources, but also our fuel mix.

We also need to anticipate how the consumer would react, how the government would react, and how businesses would react. Our resilience in reorganizing how we get to work every day and reorganizing how we turn on our light switches and that type of thing means that we could reduce the overall impact. In fact, one of the real strengths of a market economy is that consumers,

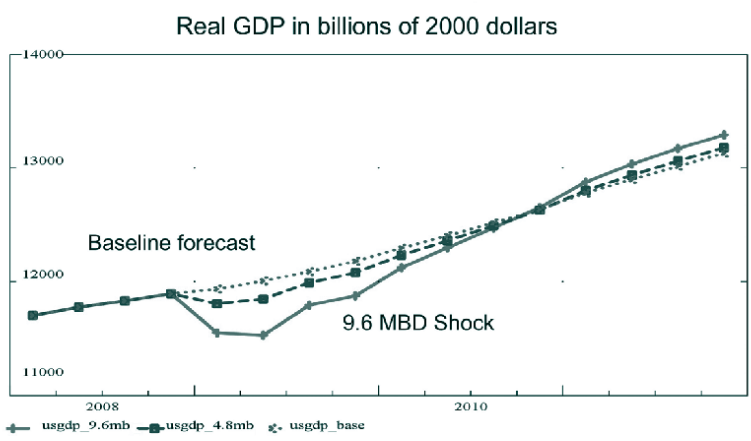

Figure 4. Oil Supply Shocks: Impacts on GDP

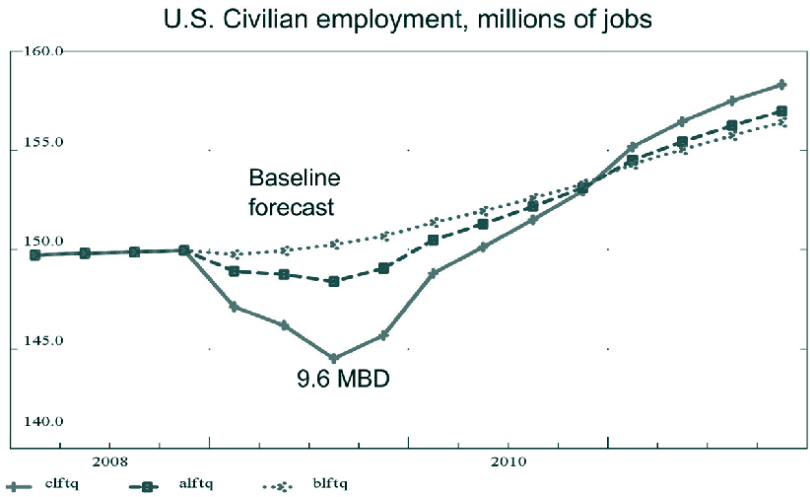

Figure 5. Oil Supply Shocks: Impacts on Employment

whether government, business, or individuals, react to prices. These points are summarized here:

- Economy's dependence on fossil fuels makes it vulnerable to supply shocks. The negative impacts of shock duration and size are exponential.
- Petroleum is a global commodity and supply shocks entail global economic damage.
- Across countries, damage is associated with dependence.
- Economic resilience—inherent and adaptive—reduce the impact of shocks. Building resilience is a good idea.
- Dependence and vulnerability can be reduced in the long run.

Let's turn the page a little bit and ask, "Okay, well, how do we reduce this?" or "How do we address climate change?" These are really the front-burner issues. What we need is strong and positive policy leadership. We also need to take advantage of our market economy that responds to incentives. That is what we need to leverage. But how do you do that? The best way to do it is to tax carbon

or tax energy. Whatever it is that you want to reduce demand for, if you drive up the price people will use less. Even your children might start turning off lights if you make it a financial proposition to them. Among the things that could be done are the following:

- Reducing energy use and carbon emissions are front-burner issues. National security issues are also salient.
- Strong and positive policy leadership that stresses economic incentives, technology, and transformation of economic structures will be fundamental. Taxes are most effective (recycled to reduce inefficient taxes on labor and capital). Not an OPEC tax.
- Gradual, but steady, transparent, and permanent policies are required.
- Several potential technology "pathways" provide strong potential.
- A long-term program of reducing fossil fuel energy dependence can make the economy less vulnerable to shocks. [1]

I find that when I talk about carbon tax people say, "Oh, no, that's the worst way to do it because I remember back in 2008 when the price of gas went up to $4 or $4.50 a gallon. That just wiped out the economy." Although it did do a lot of economic damage, the real damage comes from that OPEC tax, the fact that the income is going somewhere else. If you tax it, the income stays home (Figure 6). Now where does it go? Well, it goes to the federal government. The federal government can do stuff with that money. I am not guaranteeing they will, but there are a lot of other policies that you can take care of. One of the things you see people say right now is, "Oh, we're in the middle of a recession. That's the worst time to have new taxes or to tax energy." I say no. I say this is precisely the right time to do it. Now I am not talking about a $1.00 or $2.00 per gallon tax on gas tomorrow. The idea here is to start gradually but make sure everyone understands it is going to happen and ramp it up steadily.

The beauty of doing this now is that here we are in a time of pent-up demand, so people are going to start buying their new

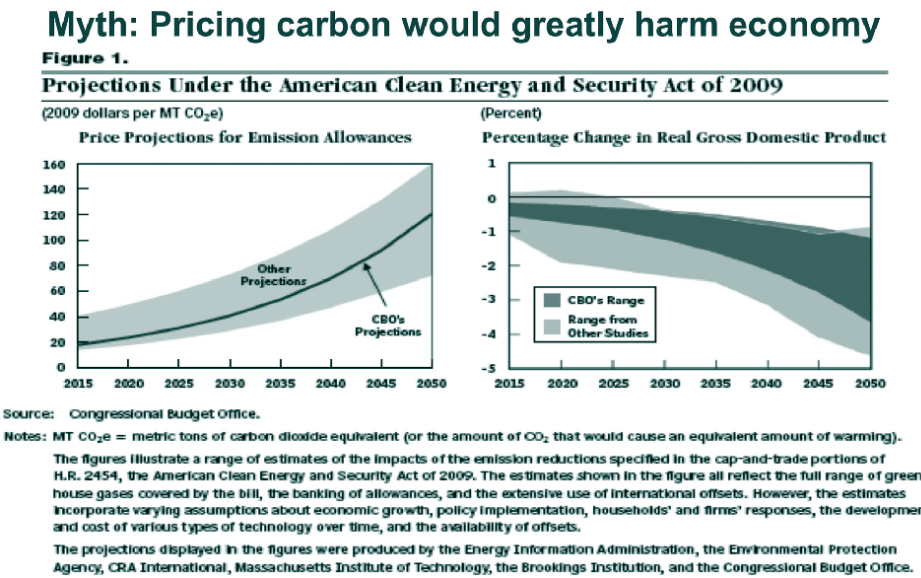

Figure 6. The Carbon Tax Myth

cars and businesses are going to start investing in new equipment at facilities. Once this recession recedes and we have an uptick in growth, people are going to run out and start buying things. If they have a strong signal that fuel is going to cost more over the next decade, they are going to buy things that conserve energy. If they do not have that signal, they are going to go out and buy SUVs. Thus, I think it is important that we go ahead and do that now, gradually but steadily and transparently.

The one thing about cap and trade or doing all these command and control things is they are not transparent to the consumers. Moreover, the changes we make have to be permanent.

Now, I would like to turn to a study we did last year for the Business Roundtable called the "Balancing Act—Climate Change, Energy Security and the U.S. Economy." [1] To conduct this study, we convened a roundtable of experts, including one in efficiencies in commercial buildings. Among other topics, we looked at how to get to the net-zero-emission building. How long would that take?

What does that take? What type of investment does that take? We also looked at transportation and at the future of nuclear energy.

Figure 7 shows energy consumption for the business-as-usual baseline, based on EIA projections. Then, here are some alternatives on how the mix could look based on what the experts felt could be done. We looked at a variety of different scenarios. What does it all mean? If we have minimal new technology, you get the bottom line in Figure 7—we keep losing GDP out to 2050. But if we have the policy leadership (and a lot of this is using the market, using that carbon tax, cap and trade, what have you, charging people for carbon), the costs are a lot less. From an economic perspective, the pricing of carbon is the most efficient way to change

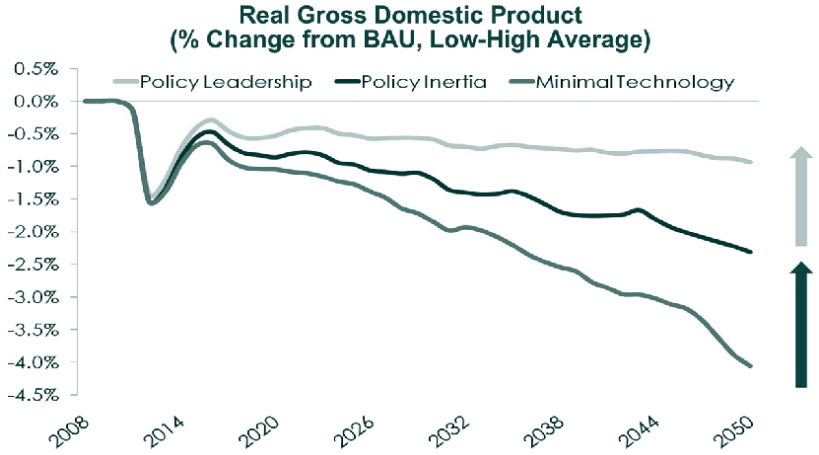

Figure 7. Energy Consumption Scenarios

behavior. That is the way to avoid the cost. Okay, so what happens? Congress says, "No. We'll avoid taxes at all cost and we'll reduce carbon the least efficient route."

I will end with one more study. [2] We recently worked with a group called the Energy Security Leadership Council, and their thinking was not so much about climate change, but about how we reduce our dependence on foreign petroleum so as to avoid

shocks from abrupt changes in demand or in price. We want the effects of these shocks, if they happen, to be less disruptive to our economy.

In the case of energy disruptions, we identified two things that we could do to reduce our dependence: One, we can reduce our consumption of petroleum and energy; and, two, we can increase domestic production. So we did a little bit of both. We reduced consumption so that imports would go down and we expanded supply. We also considered increasing production of alternative fuels. Then, we looked at what would happen if we had an oil shock in 2025 similar to the ones I discussed earlier. We found that if we could reduce our dependence, we could reduce the shock from a $500 billion hit on GDP to a $200 billion hit. Instead of losing 4 million jobs, we only lose 1.5 million.

To wrap things up, what we call E3 tradeoffs—energy, environment, and economy—are now front and center. We list some of the key considerations here:

- Energy prices, climate change, and Middle-East instability place E3 tradeoffs on center stage.
- Long-term program of reducing fossil fuel energy dependence can make the economy less vulnerable to shocks.
- If price rationing through markets is the best way to adapt to a shock, what is the best way to reduce long-run fossil fuel dependence?
- Government mandates versus energy taxes (recycled to reduce inefficient taxes on labor and capital). Energy taxes are clearly superior.
- Well-designed cap and trade schemes indirectly impose such taxes, although direct taxes are better.
- Good news: We can substantially reduce fossil fuel dependence.
- Bad news: It will take a long time to make much difference.

The long-term program of reducing fossil fuel dependence, number one, makes the economy less vulnerable to shocks. How

do we get there? If the best virtue that we have as an economy is our market-based system in which people respond to incentives, let's leverage those incentives. The best way to do that is a transparent way of showing people the true cost of energy. A carbon tax or a cap and trade system that does that in a gradual and transparent way would be the best way to go. The good news is that we can substantially reduce fossil fuel dependence; the bad news is that it is going to take a long time to make a difference.

So, we need to start now. Just because we are in the middle of a recession, we should not be saying, "Oh, no, we can't tax the economy." In fact, as I said, I think it is the time that we should do it.

REFERENCES

1. Business Roundtable, *The Balancing Act: Climate Change, Energy Security and the U.S. Economy*, June 2009, **http://businessroundtable.org/sites/default/files/2009.06.24_The_Balancing_Act_FINAL.pdf**.
2. Securing America's Future Energy (SAFE), *Economic Impact of the Energy Security Leadership Council's* National Strategy for Energy Security, 23 Feb 2009, **http://www.keybridgeresearch.com/uploads/news/41/SAFE.Study.2009.pdf**.