PEAK OIL -- (House of Representatives - June 14, 2006)

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The SPEAKER pro tempore (Mr. *Poe*). Under the Speaker's announced policy of January 4, 2005, the gentleman from Maryland (Mr. *Bartlett*) is recognized for 60 minutes as the designee of the majority leader.

Mr. BARTLETT of Maryland. Mr. Speaker, today I had a very pleasant visit with a very important person. Matt Simmons came by and we spent about an hour and a half talking. Now, who is Matt Simmons and why should we be interested in a discussion with Matt Simmons?

Matt Simmons is the President's personal energy adviser. He was the primary architect of his energy policy for his first campaign, continued with him through his second campaign. Matt Simmons is the president and CEO of one of the largest energy investment banks in the world, out of Houston, Texas, and he has written a book which I have here, ``Twilight in the Desert.''

I would like to read just a little bit from the dust cover of the book:

Saudi Arabia is the most important oil-producing nation in history. The secretive Saudi Government repeatedly assures the world that its oil fields are healthy beyond reproach, and that they can maintain and even increase output at will to meet the skyrocketing global demand. But what if they can't?

``Twilight in the Desert'' looks behind the curtain to reveal a Saudi oil and production industry that could soon approach a serious, irreversible decline.

In this exhaustively researched book, veteran oil industry analyst Matthew Simmons draws on his own three-plus decades of insider experience and more than 200 independently produced reports about Saudi petroleum resources and production operations.

What he uncovers is a story about Saudi Arabia's troubled oil industry, not to mention its political and societal instability which differs sharply from the globally accepted Saudi version. It's a story that is provocative and disturbing, based on undeniable facts but until now never told in its entirety. ``Twilight in the Desert'' examines numerous aspects of Saudi Arabia and its looming oil crisis.

Mr. Speaker, we had a discussion, as I mentioned, that was about an hour and a half long. Matt Simmons shared

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with me his concern that the world is reaching a very critical point in its history, a point at which the oil production of the world will reach a peak, after which it will inevitably decline.

This is a message that I first started talking about exactly 15 months from today. It was March 14 last year, and I have here the exact charts that we used in our discussion, and I would like to go through a few of those charts. These aren't all of them, but all of these charts are charts from that first discussion.

We started with this chart. Recent headlines. This is Washington Post, the third day of February 2005, just a few weeks before our March 14 first discussion of this subject, and the subject was Peak Oil.

You see that is pasted on because we were discussing what should we call this discussion. The Great Rollover was one possibility, and the Great Rollover refers to that time in which there will be a rollover from a consumer's market to a producer's market when you have reached the peak and roll over the top. We finally decided to call it Peak Oil, and that is how most everybody who is talking about this phenomenon refers to it now.

These are headlines, and they could be headlines from today's paper, or yesterday's, because the Dow went up a little today.

This reads, ``The Dow dropped 174 points, driven by economic damage from rising oil prices,'' and they were relatively low 15 months ago compared to what they are today, ``the plunging dollar,'' and the dollar is still plunging, ``and growing worries about consumer spending.'' It could be today's headlines.

``Recent oil price rise of 20 percent is continues to crunch the profits of struggling airlines and is believed to be a factor in disappointing retail sales.''

``Dollar slides against the euro and the yen,'' and it is still sliding.

``Consumer confidence slips in February.'' These were the headlines of the paper.

What are they talking about? They are talking about some statistics that resulted in 30 of our prominent citizens writing a letter to the President, saying Mr. President, the fact that the United States has only 2 percent of the world's oil reserve and we use 25 percent of the world's oil and we import almost two-thirds of what we use is a totally unacceptable national security risk. We have just got to do something about that.

We represent a bit less than 5 percent of the world's population. We are one person out of 22 in the world, and that one person uses 25 percent of the world's energy and we import almost two-thirds of what we use.

Now we are really good at pumping oil. We have drilled about 530,000 wells in our country. There are on the order of magnitude, and I can't get the exact number, a thousand, more or less, in Saudi Arabia. We have 530,000, and I think there may be 3- or 400 in Iraq. Two percent of oil reserves are producing 8 percent of the world's oil. I think today we are still the world's third largest oil producer. We are far and away the world's largest oil consumer. How did we get here?

To find out how we got here we have to go back about six decades. The next chart shows us a prediction that was made by a scientist of the Shell Oil Company by the name of the M. King Hubbert. He worked for the Shell Oil Company. He observed a phenomenon in oil fields when they were pumped and finally exhausted, that appeared to be a characteristic of oil fields generally, and that was you reached a maximum after which the production dropped off and finally tailed off to near nothing.

He rationalized if he could know how many oil fields there were total in the United States and guess at how many more we would find, that he could then predict when the United States would peak in oil production. He made that prediction in 1956 and on the 8th day of March, just 50 years ago, this last March 8, he gave what would become a very famous speech in San Antonio, Texas to an oil conference and it was published as a paper. In that he predicted that the United States would reach its maximum oil production in 1970. In those days he was talking only about the lower 48.

Shell Oil Company asked him not to give that talk and publish that paper because it would embarrass him and them. He went ahead and did it; and, of course, we did peak in oil production in 1970 and so M. King Hubbert became an institution in his own time.

The smooth green curve here is his prediction. The more ragged green curve is the actual date and you see, right on schedule, it peaked in 1970, and then began falling off.

The red curve here is the former Soviet Union. They have more oil than we. They peaked a bit after us, and then the Soviet Union fell apart and their production capacity did not meet expectations so they are now having a second small peak.

Of the 48 major countries that produce oil, 33 of them have already reached their peak.

The next chart shows us where we have gotten the oil in our country. M. King Hubbert was predicting the production of oil in only the lower 48 and that would be this curve here that I am tracing, because he did not look at Alaska and did not include oil from that source.

Notice that we did peak in 1970 and then it starts downhill. And the very large discoveries in Prudhoe Bay and Dead Horse, Alaska just caused a little blip in the slide down the other side in Hubbert's peak. It did not reverse that. I have been to Dead Horse and Prudhoe Bay. I have seen the beginning of that 4-foot pipeline through which, for a number of years now, a full fourth of our oil production has flowed.

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In spite of enormous production from Prudoe Bay, and in spite of a lot of production from the Gulf of Mexico, that is the yellow there. And you may remember, Mr. Speaker, the fabled Gulf of Mexico oil discoveries. They were so large that it would put any worries about oil far, far behind us. That is all the contribution they have made.

And by the way, we really are exploiting those fields because we have 4,000 oil wells out there in the Gulf of Mexico. We had reason to reflect on that last year when the hurricanes went through.

Now, these are the charts, Mr. Speaker, that I used. I had some additional ones too, but these are the charts that I used exactly 15 months ago today. It was the 14th of March. Two very significant things have happened since then. Two major reports paid for by the government have been published. One of those is the Hirsch report. It actually is dated February of 2005. That is just a month before I gave my first floor speech here on this subject. Neither I nor anyone else in the public knew that that research had been done and that report was available because it did not become available for several months after that. This is frequently called the Hirsch report. It is called Peaking of World Oil Production, Impacts, Mitigation and Risk Management. And in just a moment, I will show you a few quotes from that very important study. Then a little later than that, dated last September but not available publicly until just a few months ago, was another major study paid for by the Army, done by the Corps of Engineers, called Energy Trends and Their Implications for U.S. Army Installations. M. King Hubbert predicted that the world would be peaking in oil production about now. And the point I made 15 months ago, Mr. Speaker, was that if M. King Hubbert was right about the United States, and he was right on target, certainly, we are a microcosm of the world. And if he was right about the United States, shouldn't there have been some concern that he might be right about the world? And if in fact he was right about the world, shouldn't we have anticipated that and done something about it? We did not.

Let me show you, now, one of the quotes from the Hirsch report. That is from page 24. We cannot conceive of any affordable government sponsored crash program to accelerate normal replacement schedules. What they are saying is that if the world has peaked in oil production, and they said that it certainly would peak. It wasn't if, it was when. And they weren't really certain when it would peak because you wouldn't know that it had peaked until you were a bit past the peak and looked back. And that is very true. And they looked at all of the things that the government might do to mitigate the consequences of a shortage of liquid fuels. This is not so much an energy crisis as it is a liquid fuels crisis.

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And they said they could not conceive of any affordable government sponsored crash program to accelerate normal replacement schedules.

The next chart has some very interesting and disturbing words in it. World oil production is going to peak, they said. It will reach a maximum and decline thereafter. That maximum is called the peak. They said that it is not if, it is when. It is going to peak.

Oil peaking presents a unique challenge. And I have highlighted it here. The world has never faced a problem like this. There is no precedent. We cannot look back in history and find any time when the world has faced a problem like this. This is a unique challenge. The world has never faced a problem like this.

And as a consequence of that, the next chart says that the peaking of world oil production presents the United States and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically. Just a few years ago it was $10 a barrel. Now it is $70 a barrel and has been as high as $75 a barrel, will increase dramatically and without timely mitigation. The economic, social and political costs will be unprecedented.

These, Mr. Speaker, are quite strong words, unprecedented risk management problem and economic, social and political costs will be unprecedented.

The second report that I mentioned by the Corps of Engineers and the next chart has a quote from their study, reaches the same conclusion; that oil production will peak, that peak is either now present or imminent. And they say oil is the most important form of energy in the world today.

Just a moment's reflection on how important that source of energy is. 70 percent of all of the oil that we use in our country is used in transportation. There is no realistic alternative to liquid fuels for transportation.

Now, we can take oil and make other liquid fuels like ethanol, but for every gallon of ethanol that we burn, we have used at least 3/4 of a gallon of liquid fuels, gasoline and diesel, oil to produce that energy.

Oil is the most important form of energy in the world today, and the energy density in oil is just incredible. One barrel of oil, 42 gallons, the energy in that represents the work output of 12 people working all year. So for just a little over $100, $3 a gallon, 42 gallons, a little over $100, you can buy the workout of 12 people working all year for you.

To get some idea that that is probably a realistic number, reflect on how far a gallon of gasoline or a gallon of diesel, by the way, still cheaper than water in the grocery store if you buy it in those little bottles that you drink from, how far that will carry your SUV or your car. You may get 10 miles from a heavy SUV, but try pulling that SUV those 10 miles and see how long it will take you. You can do that with a come-along and trees and guardrail beside the road, but it would take you quite some time to pull it the 10 miles.

I drive a Prius. It gets 52 miles per gallon. And how long would it take me to pull my Prius 52 miles?

Another indication, Mr. Speaker, of the incredible energy density in these fossil fuels is the energy density in electricity. You can work very hard in your yard all day long this weekend, and I will get more work out of an electric motor, more mechanical work out of an electric motor with less than 25 cents worth of electricity. Now, it may be kind of humbling to recognize that we are worth less than 25 cents a day in terms of fossil fuels. But that incredible energy density and the really large supply of this energy source resulted in this statement by the Corps of Engineers. Oil is the most important form of energy in the world today.

Historically, no other energy source equals oil's intrinsic qualities of extractability, transportability, versa tility and cost. The qualities that enabled oil to take over from coal as a front line energy source for the industrial world in the middle of the 20th century are as relevant today as they were then. Oil is absolutely essential to our way of life.

The next chart notes some very prominent people. Colin Campbell, more than any other person, he probably inherited the mantle from M. King Hubbert, Jean LaHerrere, Brian Fleay, Roger Blanchard, Richard Duncan, Walter Youngquist and Albert Bartlett. Not a relative of mine, but if you go to the web and pull up Albert Bartlett you can get his speech that he has given more than 1,600 times. I will tell you, Mr. Speaker, that I think you will agree with me it is the most interesting 1-hour lecture you will ever hear.

All of these people have estimated that a peak in conventional oil production will occur around 2005. And then they quote some corporations that have reached a similar conclusion.

The next chart is another quote from this very important study by the Corps of Engineers. In general, all nonrenewable resources follow a natural supply curve, just as M. King Hubbert said 50 years ago. Production increases rapidly, slows, reaches a peak and then declines at a rapid pace, similar to its initial increase.

The major question for petroleum is not whether production will peak, but when. There are many estimates. Most of the authorities agree that it is either now or imminent. Very few push it off more than a decade into the future.

The next chart is really interesting. Now, this is dated just last September. The current price of oil is in the $45 to $57 per barrel range. Now it is $70 to $75, a little under $70 today. But it has been in the $70 to $75 range. And it is expected to stay in that range for several years. It is less than a year later and it is now $70 a barrel. They expected it to stay in the range of $45 to $57 a barrel for 7 years. So even the experts have underestimated the relationship between production and consumption.

Oil prices may go significantly higher. Indeed, they have gone up to $75 just a few weeks ago. And some have predicted prices ranging up to $180 a barrel in a few years.

Now, the next chart shows that not everybody agrees with this. And this is a very interesting chart. This is a chart from our Energy Information Agency, and we have had the two top officials of that agency in our office to talk about these subjects. And this is a chart which shows historically what production has been, and it shows what they think the future looks like.

Now, they use a very interesting and, one might say, bizarre use of statistics. In statistics there is a 95 percent probability; that is, you are 95 percent certain about what is going to happen in the future, and then there is a 50 percent probability, which is obviously less certainty about what is going to happen into the future. And then finally, a 5 percent probability. And boy, that is really uncertain. There is just a big, big envelope out there. Could be anything in a broad field.

Well, what they have done in this chart is really very interesting. They have taken the 95 percent probability, which is the yellow line here, and then they have taken the 50 percent probability, which is the green line. But they took the 50 percent probability only on the plus side of the 95 percent probability. You need to draw another green line that is just as far on the other side of the yellow line. Then they draw the blue line there, which is the 5 percent probability, but they should have drawn another one, which is just as far on this side of the yellow. In other words, the 5 percent probability says you are very uncertain about the future. There could be a whole lot more oil in the future, or there could be a whole lot less oil in the future. But they look at only the whole lot more oil in the future.

And then they make a very interesting designation. They say that the 50 percent probability is the mean. The 50 percent probability, Mr. Speaker, has nothing to do with the mean. And I wanted to make certain, and I did have a course in statistics many years ago. I wanted to make certain that I had not forgotten and was misinterpreting this, so we had experts from the Congressional Research Service come over and discuss this with them. And they said that they agreed that this was a very unusual, one might say bizarre, use of statistics.

Well, Mr. Speaker, you see what has happened since they made this prediction. Here they predicted these three different scenarios, the 95 percent probability, the 50 percent probability, which they said was the mean, the most probable. 95 percent probability is

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far more probable than 50 percent probability.

But look what reality has been. Look what the red line, look what the actual data points have been. They have been following, as you would suspect they would, the 95 percent probability.

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The next chart shows a somewhat expanded application of this use of statistics. A couple of Congresses ago, I was privileged to chair the Energy Subcommittee on Science, and I wanted to determine the dimensions of the problem. So we had the world's experts come in. And they just about all agreed fairly unanimously that we probably had about a thousand gigabarrels of oil remaining in the world, 940 to 1,030, something in that range. Now, we use gigabarrels because, surprisingly, a billion in our country is different than a billion in England. Apparently, a billion in England is a million million. One billion in our country is a thousand million. But everybody knows what a giga is; so we talk about gigabarrels. They now, using what they call the mean, and 50 percent probability, Mr. Speaker, is not the mean, but they say that if that is the mean, then they expect to find roughly another thousand gigabarrels of oil.

Mr. Speaker, even if that is true, this chart shows us a very interesting thing. The black curve here shows the actual production, and we are about at a peak here, and most of the experts believe that it will level off and then fall down, following a curve very much like the upslope here. They believe that there is another thousand gigabarrels of oil out there, roughly, that we are going to find. Eight hundred, roughly, gigabarrels of oil that we are going to find. If that is true, that pushes the peak only to 2016. That is only 10 years from now, Mr. Speaker, even if they are right. And the odds that they are right are very, very small. There is almost nobody else who agrees that this is a proper use of statistics. Even if they are true, it pushes the peak out only 10 years.

In the Hirsch Report, they said that if you did not plan for this peaking at least 20 years ahead that you were going to have rather serious economic consequences of that. Obviously, even if they are right, it is only 10 years ahead; so we do not have 20 years to plan.

This curve shows another very interesting thing, and that is what would happen if you really were very clever and worked very hard and had some breakthroughs so that you could pump the oil more quickly? And what they show there is that that might push the peak out to 2037, roughly another 20 years. But look at the consequences of that, Mr. Speaker. Notice the drop-off. It drops off almost like you have fallen off a cliff. You obviously cannot pump oil that you have not found. And if you pump it now, you cannot pump it later.

Let us read on the next chart what one of the world's experts on energy says about the assumptions that they make here. Now, that was a chart from the Energy Information Agency, but they get their basic data from USGS. And this is what Gene Laherrere says about that: ``The USGS estimate implies a fivefold increase in discovery,'' to give you that, roughly, extra 800, 1,000 gigabarrels of oil, ``and reserve addition for which no evidence is presented. Such an improvement in performance is, in fact, utterly implausible given the great technology achievements of the industry over the past 20 years, the worldwide search and the deliberate effort to find the largest remaining prospects."

We now are very good. We have computer modeling. We have 3-D seismic, and there is not much quarrel among the world's experts as to how much oil remains and where it will be. The people actually out there looking for oil do not have the wild disagreements that those who are back modeling with computers have who are using what I think is an unusual application of statistics.

The next chart shows us something that Albert Einstein would encourage you to reflect on. He was asked, after he discovered nuclear energy, ``Dr. Einstein, what will be the next great energy force in the world after nuclear energy?" And his response was that the most powerful force in the universe was the power of compound interest. And that is exponential growth, and these several curves here look at exponential growth. The lower straight line there is not exponential growth. It is 2 percent growth, and you extrapolate that out. In other words, it is like putting your money in the bank and it gets some interest, and every time you get some interest, you take the interest out. That is this growth.

This curve line that starts out at the same place is what happens if you leave your money in the bank and you are getting interest on interest. It gets ever steeper and steeper and steeper because the principal on which you are collecting interest grows and grows and grows.

This is a 4 percent curve. This is a 5 percent curve. And, Mr. Speaker, this is a 10 percent curve. It doubles in 7 years.

A good rule of thumb, by the way, is if you take the rate of growth and divide it into 70, that will give you the doubling time. So 2 percent growth into 70 gives you 35 years doubling time. This, by the way, is almost exactly the rate at which China and India are growing.

And they are going to need oil, Mr. Speaker, for that growth.

The next chart is a simple schematic which presents us with several realities that we really need to reflect on. This is the 2 percent growth curve. Now, I can make that growth very steep by compressing the abscissa and expanding the ordinate here. But this is a 2 percent growth curve. That yellow area represents the difference between what you will have if we peak here and what you would like to have because this is demand. That is that 2 percent demand curve from the previous chart. And you see that you actually start to have a deficiency some time before peaking. By the way, that yellow area covers 35 years. We know that because this point is half as high as that point, and that is a 35-year period. It doubles in 35 years.

So most of the world's experts believe that we are at or near peaking. Now, this presents us with a couple of real challenges, Mr. Speaker. We now have no surplus energy to invest in alternatives. Every bit of the oil that we are producing is needed by the world's economies. As a matter of fact, they would like to have more. Because there is hardly enough oil to meet the demands, the price has gone from $10 a barrel just a few years ago to $70 a barrel now. So if we are going to have any energy to invest in alternatives, we are either going to have to find a lot more energy somewhere else, and the next chart will show how unlikely that is, or we are going to have to free up some energy by not using all the energy we are using now. In other words, an aggressive conservation program to push this peak down so that we have a little bit of energy here to invest in alternatives. By the way, that maybe is not a little bit.

Let me give you just one example of this investment. If you build a nuclear power plant, it may take you 10 years to permit and build it. Maybe we can shrink that, and I hope we can, to 5 years. That would be pretty quick, Mr. Speaker, to shrink that to 5 years. Our present nuclear power plants, you must operate them 20 years before you get back the energy that you have put into them. Lots of fossil fuel energy is used in making these nuclear power plants. What that means is that with today's permitting and with today's nuclear power plant efficiencies, it would be 30 years, if you started today, before you would get any net energy. Now, maybe we can do better and shrink the permitting and construction to 5 years, and maybe we can have more efficient nuclear power plants so that it only takes 15 years for payback. But even that, Mr. Speaker, 5 plus 15 is 20 years. What that means is if you started today to build nuclear power plants, it would be 20 years, best case, before you had net energy, and in the meantime you are going to have to get the energy to produce the nuclear power plants by depressing the present use of energy because we do not have any spare energy. There is no surplus energy if, in fact, we are at peak oil. That is what it means. That is peak. There is not going to be any more.

The next chart is a really interesting one and shows essentially the same things here. The bar graphs here show the discovery. And you notice that we made some pretty big discoveries way back in the 1940s, some really big ones in about 1950. And, boy, we really learned how to find oil in the 1960s and

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the 1970s. But at about 1980 our discovery of oil became less than our use of oil. The heavy black line here represents the consumption of oil, how much oil we have used. So for all of these years up until we get to about 1980, we are always finding more oil than we use. We use this much of it under the curve, but all this above the curve is now surplus oil. It is reserve oil that we have to use in the future. We have been eating into that reserve since about 1980 because, you see here, we have found just this amount of oil, but we have consumed this amount of oil; so this shaded area in between them represents the amount of the reserves back here that we have used.

Now, you can within limits make the future look about any way you wish, within some very realistic limits. First of all, you have to decide how much more oil you are probably going to find. The world's experts believe that we have probably found about 95 percent of the oil that we are going to find. As a matter of fact, if I was extrapolating and smoothing this curve, I would come out at a lower curve than they would come out at. But that shaded area there, it is not going to be that smooth, obviously. It has never been smooth. It is up and down. But on average they believe that is the kind of oil that we are going to find in the future.

There is one thing that is an absolute certainty. The area under the consumption curve will not be greater than the area under the discovery curve. That is the quantity that you consumed. If you take the area under that curve, that is the total amount that you have consumed. It is like adding up a whole bunch of little bar graphs. That is what we have here is a bunch of bar graphs. And the area under the discovery curve represents the oil that has been discovered. It is obvious, Mr. Speaker, that you cannot pump what you have not discovered. So if you are going to make the future look much difference than this, you are going to have to make some different assumptions about how much oil you are going to find in the future.

Now, you can get the oil a little more quickly by using some aggressive techniques, enhance the oil recovery by injecting COG, pumping seawater in it. And, by the way, the Saudis are now pumping about almost two-thirds seawater, and they have always pumped some. They flood the periphery of the fields with seawater to push the oil into the center, and then they pump it out, and now they are getting about two-thirds seawater. But never mind. Oil is different from water and separates from water, usually lighter than water; although the heavy crude may not be lighter than water, as the name implies. But it is easily separated from water. So you now, Mr. Speaker, can kind of predict what you think the future will be by looking at this curve, remembering that you cannot pump what you have not found.

I would like to go back for just a moment to the previous chart I showed that shows a challenge that we have, and that is the challenge of the gap. The gap is the difference between what is available and what you would like to use. Now, people have been focusing on filling the gap. I would like to suggest, Mr. Speaker, that for a couple of reasons that ought not be our focus. First of all, I am not sure that we can fill the gap. And, secondly, since there is a finite amount of fossil fuels in the world, if we fill the gap now, there will be less to use later.

I am beginning, Mr. Speaker, to be more and more concerned about a moral element to this discussion. We now are passing on to our children and our grandchildren, not with my vote, but we are now passing on to our children and our grandchildren the largest intergenerational debt transfer in the history of the world. We cannot run our government on current revenues. And we are now going to not only require our children and grandchildren to run their government on current revenues, they are going to have to pay back all of the money that we have borrowed from their generation. Now, Mr. Speaker, should we compound the problems that we are bequeathing to them by pumping now the oil and the gas that they would need to sustain their economy? There is only so much there, Mr. Speaker. If you pump it today, it will not be there tomorrow.

I am opposed to drilling in ANWR, not because of environmental concerns necessarily. I think they do a very good job. They build roads in the winter out of crushed ice. When spring comes, you cannot see where the road was. They have a very small footprint. But, Mr. Speaker, I am having a lot of trouble understanding how it is in our national security interest. If we have only 2 percent of the world's oil and use 25 percent of the world's oil and import two-thirds of what we use, I am having a lot of trouble understanding how it is in our long-term national security interest to pump that little bit of oil we have got as soon as we can. If we could pump ANWR tomorrow, what would we do the day after tomorrow? And the day after tomorrow is when our kids and our grandkids are going to be faced with the necessity of supporting the economy and paying back the enormous amounts of money that we have borrowed from their generation. So I am having a problem, Mr. Speaker, with trying to fill that gap.

The next chart shows us what the SAIC study, the Hirsch Report, suggested as a way to fill the gap.

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But notice that if you start now, and zero is now, that you don't have hardly anything for at least 5 years. And then it slowly grows. They are going to fill it with enhanced oil recovery. If we pump it, our kids can't pump it. They are going to fill it with coal liquids. If we use the coal, our kids won't have the coal. They are going to fill it with heavy oil--oil is like the tar sands in Canada and the oil shales in our country--and gas to liquids. If we use those things, our kids aren't going to have those things.

You notice they don't have wind here. They don't have solar there. That is because these now, although they in the future will be enormously important, they provide minuscule contributions now. To ramp those up is going to take more time than they thought was available. And so you could get there quicker in filling the gap with exploiting these finite resources that when they are gone, they are gone.

The only one which is sustainable is efficient vehicles. The average car and light truck is in the fleet about 16 years, the average 18-wheeler for 28 years. And so if you start using more fuel-efficient cars, it takes a long time to turn over that fleet. You notice, they didn't see a thing for about 5 years nearly, and then slowly increasing the contribution that it made.

The next chart, Mr. Speaker, looks at what the options are that we have. Obviously we are going to get our energy from somewhere. As we slide down the other side of Hubbert's Peak, the world will be looking for energy from other sources.

What will they be? Well, we have listed here, at least generically I think, all of the potential sources. We have some finite resources: the tar sands, the oil shales, coal, nuclear, two kinds of fission and fusion.

Just a word about the tar sands. Canada calls them oil sands. It is really tar. Its quality is little better than the asphalt parking lot out here which, by the way, if you put a blowtorch on it will flow. They now are mining that with shovels that have 100 tons in one shovel, dump it in a truck that hauls 400 tons and then they cook it, heat it up, to get the oil out.

You are told a lot of things, Mr. Speaker, and what we really need is an honest broker so that we can have facts that we agree on. I don't know whether this is true or not, but I am told that they are using more energy from stranded gas; stranded gas is gas where there is nobody nearby to use it and it is hard to ship so it is very cheap when it is stranded. They are using more energy from natural gas than they are getting out of the oil that they produce.

Dollarwise, it's a good bet. Eighteen dollars a barrel to produce it. They're getting $70. That is really a moneymaker. But in terms of energy-profit ratio, it obviously wouldn't be something that you would want to do indefinitely. The oil shales in our country are very difficult to exploit. Shell Oil Company has been there. It will be 2013, they tell us, before they will even decide whether it is economically feasible to get that oil. There is an incredible amount of oil there, more reserves there than all of the Middle East. But there is probably also more energy in

the tides than all the oil energy in the Middle East, but because it is so diffuse, it is difficult to get out and that is kind of the problem with these tar sands and oil shales. Ultimately we will get them out, but we are not going to get them out in large enough quantities quick enough to fill that gap.

Coal. Let's put the next one up, then I will come back to this. I just want to talk about coal for just a moment, because many people will tell you not to worry about the future because we have got 250 years of coal out there. That is true; 250 years at current use rates. But, Mr. Speaker, you remember those exponential curves we showed and what happens with exponential growth. Albert Einstein says it's the most powerful force in the universe. If you increase your use of coal only 2 percent, and I will submit that when oil starts running down, we are going to increase the use of coal far more than 2 percent to make up that difference. By the way, it is pretty easy to liquefy it with a Fischer-Tropsch technique. Hitler used it. We denied him access to oil, which is, by the way, one of the reasons that he went to a second front in Russia that lost him the war, because he was running out of coal. He needed Russian oil, so he went to that second front in Russia.

With a 2 percent growth, that 250 years now shrinks to about 85 years. But you can't fill the trunk of your car with coal, so if you are going to make a liquid of it or a gas of it, you are going to have to use some energy to do that. So now that shrinks to 50 years. So we have got 50 years of coal left, with only a 2 percent increase in growth if you are going to convert it to a gas or a liquid. By the way, with either a big economic penalty for cleaning it up or a big environmental penalty if you don't clean it up, because almost all the coal we have left in our country and in the world, for that matter, is pretty dirty coal with high sulfur. The good clean stuff we have pretty much used.

Now back to the first chart we were looking at, which goes through the other things that we might use. These are the finite resources. They are there. You need to husband them and use them wisely. We could go to nuclear lightwater reactors, the kind we have now. There is a big argument, by the way, as to whether we ought to go to more nuclear or not. Twenty percent of all of our electricity, 8 percent of our total energy but 20 percent of our electricity is produced by nuclear. In France, that is about 85 percent produced by nuclear. You can either have the lightwater reactors, but there is a finite amount of fissionable uranium in the world, so by and by we will go to breeder reactors, of which we have none. And in transporting that stuff and enriching it, you produce some bomb-grade materials and so you have to be very careful with that. You buy some problems with it. But breeder reactors are what the name implies, breeder reactors, and they make more fuel than they may use.

Then there is fusion. Mr. Speaker, if we get there, we're home free. The analogy I use is if you think

you're going to solve your personal economic problems by winning the lottery, then we are probably going to solve our energy problems with fusion. I think the odds are about the same. That doesn't keep me from supporting that. We put about $250 million a year in it. I would vote more if there were more capability out there, because it is the only energy source for the future where we are really home free. So we need to explore it, but I wouldn't bet the ranch that we're going to get there.

Then we have the truly renewable resources. They now are pretty much in the noise level. Solar. Today, 1 percent. That is up. It is growing. It grew 60 percent last year.

Wind. I think that grew about 35 percent last year.

Geothermal. That is real geothermal, tapping down into the molten core of the Earth and getting water that is close enough to there that it is hot. There is not a chimney in Iceland, I think, because they have enough geothermal power.

Ocean energy. A lot of energy there. The tides, the waves, ocean thermal gradients. But it is very diffuse. Very hard to harness. We are trying. We need to do more there.

Agricultural resources. Soy diesel, biodiesel, ethanol, methanol, biomass. In a couple of moments we will come back to talk a little more about those and what confidence you ought to have that they are going to make a really big contribution to our energy supply.

Waste energy is a really good one. That is burning trash instead of burying it out there. There are places doing that. We have a great facility up here in Montgomery County at Dickerson. They will be happy to show you that. It really is very current state of the art.

Hydrogen from renewables. Just a quick word about hydrogen. Hydrogen, Mr. Speaker, is not an energy source. We will always use more energy producing hydrogen than we get out of hydrogen. Else, we will have to suspend the second law of thermodynamics and if we can do that, we can suspend gravity, and then we have lots of opportunities. Always we will use more energy producing the hydrogen than we get out of it.

So why should we even bother? For two reasons. One is when you finally burn it, you get only water. That is really not a pollutant. The second reason is that if we are ever able to perfect economically supportable fuel cells, hydrogen is very convenient to use in a fuel cell.

I drove a fuel cell car the other day. We had an energy-efficient car showcase out in Frederick, Maryland. The major manufacturers came out there and brought their cars. I drove a fuel cell car. It cost a million dollars. The fuel cell will last a couple of hundred hours. We are working on fuel cells, but it will be a while before we get there. But if we get there, and I think we will, then they have at least twice the efficiency of the reciprocating engine. That is why we look at hydrogen. It is not a savior. It will help.

The next chart looks at ethanol. This is an interesting chart. It shows on the top that you need about 1.23 million Btus of fossil fuel energy to get 1 million Btus in the tank of your car. Obviously it takes energy to drill a hole and pump it out and refine it and transport it and so forth.

This slide looks at energy from corn, from ethanol. This is about as good as we will ever get. Many people tell me this is wildly optimistic, but I think we can get there. What this says is that to get 1 million Btus of ethanol energy, you have got to put in .74, three-fourths as many Btus as you get out. What that means, Mr. Speaker, is that every gallon of ethanol that you burn in your car represents three-fourths of a gallon of fossil fuel that it took to make the ethanol. So a gallon of ethanol doesn't offset a gallon of gasoline. If you make ethanol from corn, 13 percent of our corn crop will produce enough ethanol to displace 2 percent of our gasoline. But you have used a lot of fossil fuel energy producing, growing the corn.

This little chart at the bottom shows the energy input in producing a bushel of corn. The big purple slice here, 40-odd percent, is nitrogen fertilizer which today is made from natural gas. Mr. Speaker, I suspect there is almost nobody off the farm who knows that when they are eating broccoli that they are eating recycled natural gas, because that is where the nitrogen came from to grow the broccoli.

These are all the other energy inputs from oil. Planting it, harvesting, building the tractor, making the tires for the tractor.

If we were going to grow corn with the energy from corn, using that, 13 percent of the corn crop would replace 2 percent of our gasoline. We would have to double our corn crop and use all of it for ethanol if we were going to replace just 10 percent of our gasoline.

Mr. Speaker, this gives you something of the dimensions of the problem that we face. There is a lot of talk about ethanol. Brazil makes a lot of it from sugar cane. It is more efficient than corn. You use the whole stock rather than just the kernel and they don't use much fossil fuel energy. You see people down there planting it by hand, harvesting it by hand, and so forth. So they do not have anywhere near the fossil fuel energy input into their ethanol that we have.

By the way, we will never make ethanol from sugar cane in our country because sugar is so high. I don't know how expensive gasoline would have to be before we could afford to make ethanol from sugar, and that is what it is made from. It is made by fermenting sugar.

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I have a really interesting analogy that helps us understand this chart. We are very much in our country like a young couple that has gotten married and their grandparents have died and they have a big inheritance and they have now established a lavish life-style, where 85 percent of the money they spend comes from their grandparents' inheritance and only 15 percent from their income; but their income is going to give out before they retire so they have obviously got to do something. They have got to make more or spend less. That is exactly where we are. Eighty-five percent of our energy, some people say 86, 85 percent of our energy comes from natural gas, petroleum, and coal and only 15 percent from other sources.

[Time: 20:45]

A bit more than half of that comes from nuclear. That could and maybe should grow. We need to talk about the pros. By the way, I have friends who were devoutly anti-nuclear. These were bright people.

But when they considered the alternative, which may be shivering in the dark, nuclear is beginning to look better. Seven percent of the total, and this is year 2000, we are a little better than that today, but only 1 percent of 7 percent, that is .07 percent. That is a trifling amount that came from solar. That has been growing.

Last year it was maybe 60, so now it is not up to .07 percent, but maybe it is 1 percent. But it is still a very small amount. Wood, that is the paper industry and timber industry wisely using a waste product that probably is not available to the rest of us and probably can't grow much to maintain our woodlands. Waste energy that ought to go and could go.

Wind again, 1 percent, that has grown some. That is 1 percent of 7 percent, by the way. It has to get seven times bigger, to be 1 percent of a whole thing. Congressional hydroelectric, that is not going to grow in our country. Micro-hydro might.

China is really exploding in their use of micro-hydro. That is using little streams where you probably don't have the environmental impact that you probably do in the large streams. That could grow in our country. We have not even begun to exploit that here.

Down here is agriculture, alcohol, fuel. That was about 20.07 percent. That is more now. That is growing, but still is very small compared to the total amount of energy used.

Then geothermal. The next chart shows something really challenging. The next chart shows the challenge we have of being more efficient. Most energy you get out of an incandescent bulb is heat. That is the blue here, the dark blue. The light is this little bit on top. Now to get the same amount of light from a fluorescent, you produce only this much heat. But look what happens when you go to a light emitting diode. This is the light that is the heat.

If you think, that is why if you buy an LED flashlight you will forget when you put the batteries in it, because they will last so long compared to the length of time they last, where with the conventional incandescent bulb, what, 90 percent of the energy goes to heat.

The next chart shows an interesting one. I wanted to show this, because many people say not to worry, the market will take care of it. There are many market worshippers out there who believe that the market is both omniscient and omnipotent.

This is a little example of what has happened in this market. This was the oil price by hike that didn't produce any commensurate increase in production of oil. It is because it just wasn't there.

The market will work if there are infinite resources. Mr. Speaker, there are not infinite resources here. The next chart shows that you can live on less and live well. The average Californian only uses about 65 percent of the energy of the rest of us. That is because of the many regulations they have out there with more demand, efficiency.

The next chart shows a very interesting one. This shows a satisfaction with life. This shows satisfaction with life relative to a GDP. Here we are. We have the highest GDP. But we don't have the highest satisfaction with life.

There are a dozen countries that have a much smaller GDP per capita, who are happier with life than we are. It is obvious that you can be happy using less energy than we use.

The next chart is one that just is stunning when you first see it. This is a history of the world. Only of 5,000 years recorded, this is the last 400. We entered industrial age, wood, coal, appropriately black, and then gas and oil.

Look what happened with gas and oil. It just explodes. It is standing on its end. By the way, the population followed that. Half a billion to a billion people here, nearly 7 billion people there.

Now, it will come down the other side as fast as it has gone up that side. What will we do? The age of oil will be about another 100, 150 years, and then we will be through the age of oil.

The next and last chart shows what we have got to do. We have got to buy time. We must depress our use of energy efficiency conservation so we have some energy to invest in alternatives and some time in which to do it. Then we must use it wisely. We need something equivalent of DARPA. ARPA-E is a suggestion, some organization that looks at that time energy we have got and the resources we have got. What is the best bet. Where could we use it to get the most good.

There will be a number of benefits in that. America could again become the industrial capital of the world. We could be exporting this technology. Whether we like it or not, we are a role model. We are one person out of 22. We use 25 percent of the world's energy. I genuinely believe that if Americans understood the problem they face today they would rise to the challenge.

I lived through World War II. Everybody was involved. I believe we are creative and innovative, and we can solve this problem. I think you could sleep really good when you went to bed tonight, recognizing you used less energy today than you were yesterday, and you were happier today than you were yesterday.

We need to face this challenge. We will face it. I think the earlier we face it, the better off we will be.

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