The American people, indeed people all around the world, are very concerned about energy- its availability, reliability, cost, and environmental impact. In the US, energy is also the subject of urgent policy discussions. But energy is a complex subject, touching every part of daily life and the overall economy, involving a wide variety of technologies, and deeply affecting many aspects of international relations. And the facts about energy are not widely understood.

Within this context, the NPC completed a study which we hope will inform and shape the energy debate, enhance widespread understanding about the scale and significance of the industry's activities, and propose sound, balanced strategies to meet today's challenges and to benefit future generations.

Our objective is to provide you with a very brief summary of what we have done.

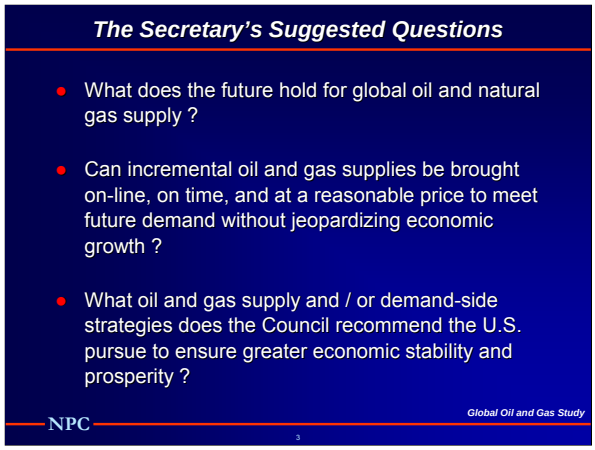
The study origins date back to June , 2005, when the Secretary of Energy, Sam Bodman, delivered an insightful speech to the annual NPC gathering. He outlined his view of the considerable challenges facing the oil and gas sector, noting that perspectives on the future vary widely.

This presentation is divided into 3 parts. First, I'll describe the approach taken by the group explaining what makes this study different.

I'll then explain what we learned on this journey - sharing our principal findings which we have called "the hard truths". These findings recognize the global nature of the energy industry, the enormous scale of our activities, and the very long timelines involved in effecting material changes across the supply chain

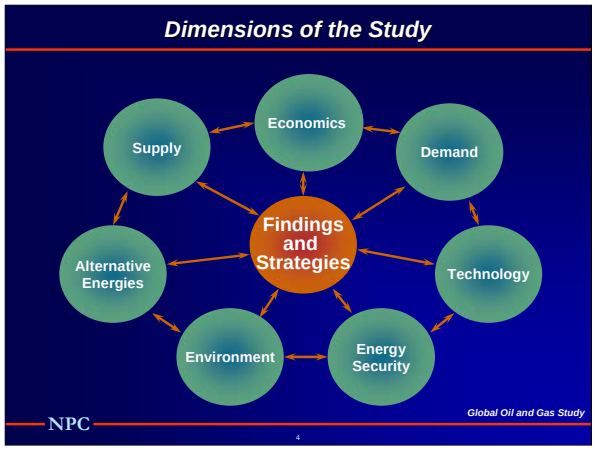
.

Finally, I'll zoom in on the United States to explain our proposed integrated set of core strategies that we believe are critical for the country to pursue.



The impetus for the Global Oil and Gas Study began with a letter sent by Secretary Bodman to the NPC in October 2005. In that letter, the Secretary suggested three questions that we might consider :

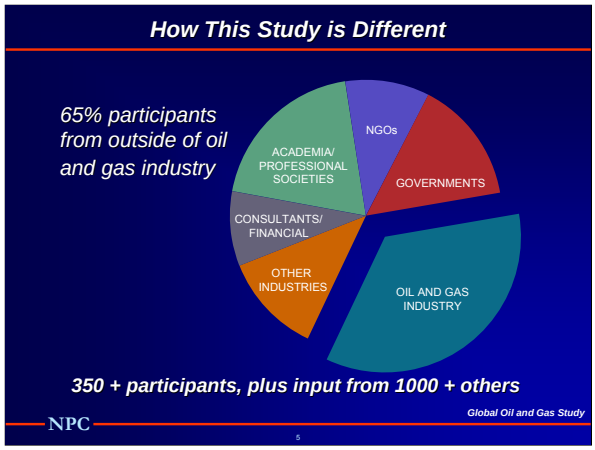
Refer to above



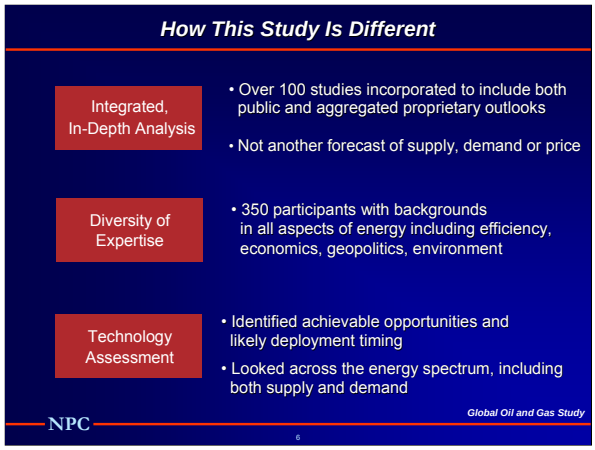
We considered these questions deeply in designing up-front an organization and methodology to handle energy subjects that are at once highly specialized but also interdependent. Two separate teams were set up to assess demand and supply; a third team focused on technology; and a fourth team, geopolitics and policy, considered what might be called "above ground" issues. No analysis of the future of oil and gas would be complete without consideration of the potential alternatives to oil and gas - biomass, other renewables, nuclear, coal - so we organized expert resources to address such topics through subgroups. In preparing our findings and recommendations, we were at pains to consider all options through

(🖱)

economic, environmental and security lenses - creating a balanced set of outcomes not always obvious in other parallel studies. The efforts undertaken to gather information and develop conclusions were truly open and transparent; with ideas recycled continuously across and among diverse teams, and finally integrated into the report we present for approval today.



Participation in this study has been broad - over 350 participants have been engaged from within the NPC and beyond. We were frankly overwhelmed by the time and efforts offered voluntarily by so many diverse organizations - such is the general interest in rising to the challenges ahead. You will note about two-thirds of the participants come from outside the oil and gas industry bringing different and expert perspectives. In addition, we reached out to over 1,000 third parties involved in the energy sector for their ideas and opinions. There has been an intense interest in this Study, and we greatly appreciate the efforts of so many talented people.



There are three primary reasons why we think this study is different from many others.

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Integrated In-Depth Analysis

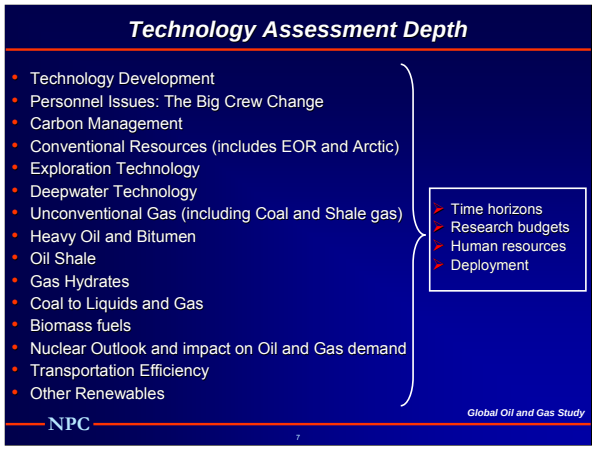
(🖱)

Diversity of Expertise

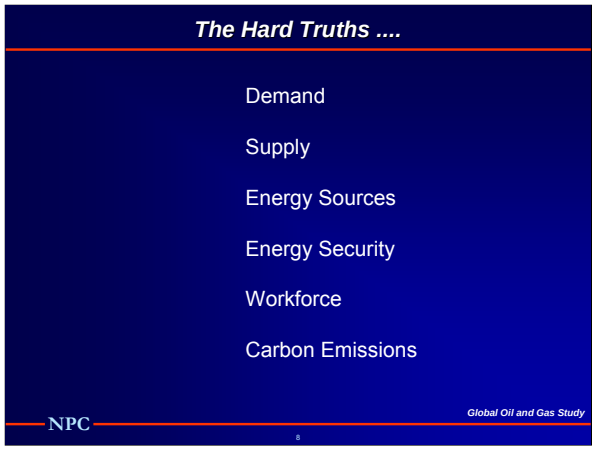
(🖱)

Technology Assessment

Refer to wording on slide



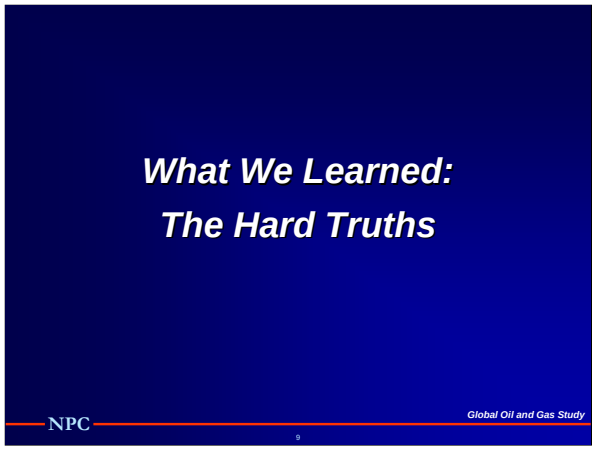
Let me dive into technology a little deeper and show the range of subjects considered - it's a long list covering topics ranging from CCS, to deepwater exploration, to biomass fuels, to transportation efficiency. We asked more than 120 subject matter experts in the Technology Task Group to investigate and come to agreement on time horizons, research budgets, human resource requirements, and deployment in each specialist area. This task was achieved and topic papers covering the outstanding work of the Technology teams are available on CD-rom, and will be released with the full approved report.

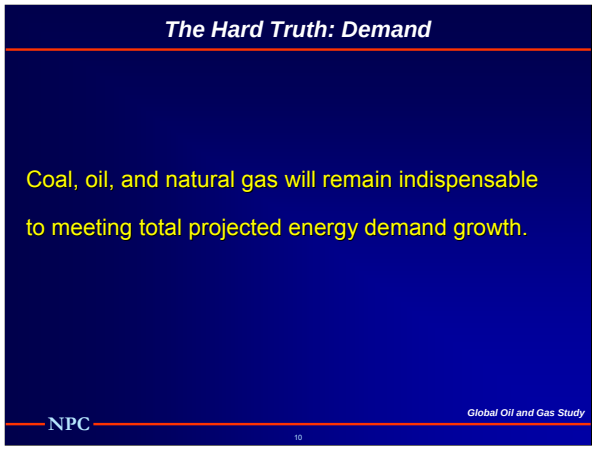


So, the approach to this Study enabled us to include a broad group of people assisting our understanding of the complex energy world - summarized now in a set of findings. Findings we have called the hard truths about energy.

There are 6 hard truths.

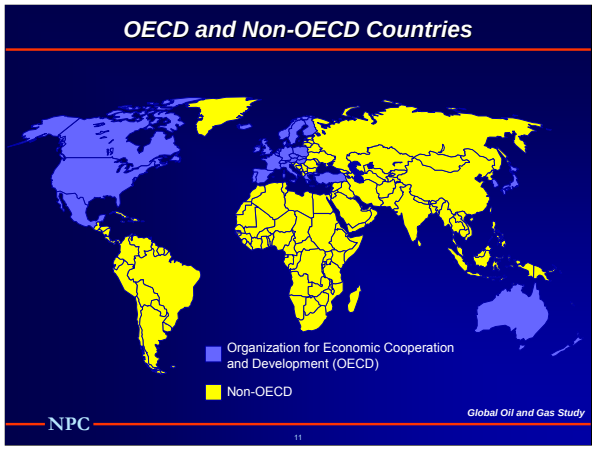
Refer to above.


What We Learned:
The Hard Truths
NPC
Global Oil and Gas Study
9



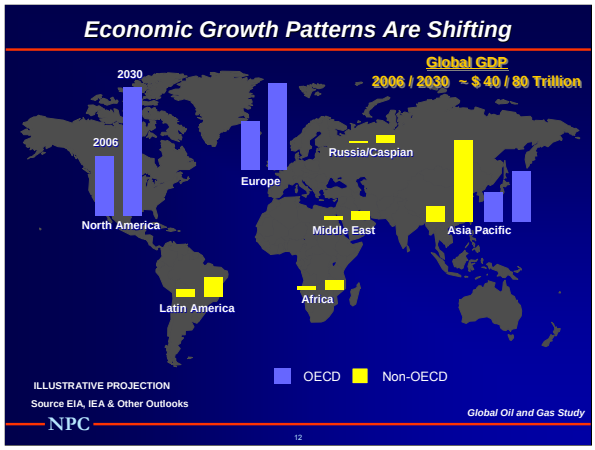
The Hard Truth - Demand

Read above.



The member countries of the Organization for Economic Cooperation and Development, the OECD, have historically been identified as developed countries. Countries outside of the OECD, the non-OECD countries, have historically been identified as developing countries. Whether those labels are still appropriate is a question, but in any case they do provide useful grouping when looking at energy demand trends. The blue shaded countries are OECD members, the yellow shaded areas are non-OECD countries. We use this color scheme consistently in the presentation.

Organization of Economic Cooperation and Development (OECD) – 30 Member Countries
Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Mexico, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States



Income and population are two of the most important variables that determine energy demand. As prosperity rises and hence as income rises, so does demand for energy.

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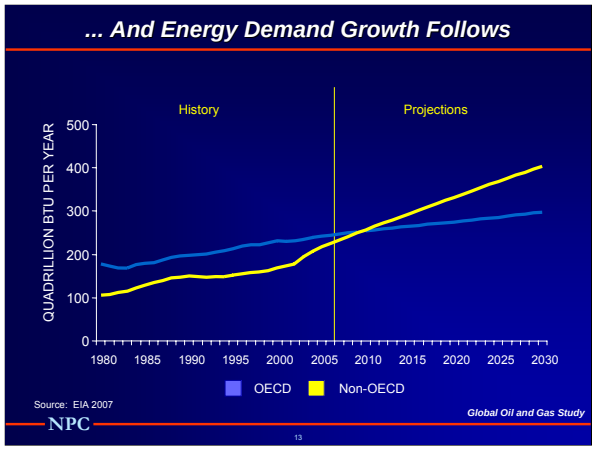
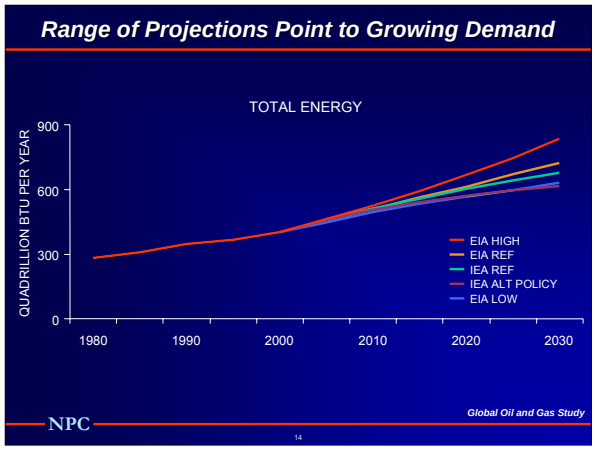
In the years to 2030 global GDP is projected to double with the highest percentage growth and much of the absolute growth occurring in non-OECD regions.

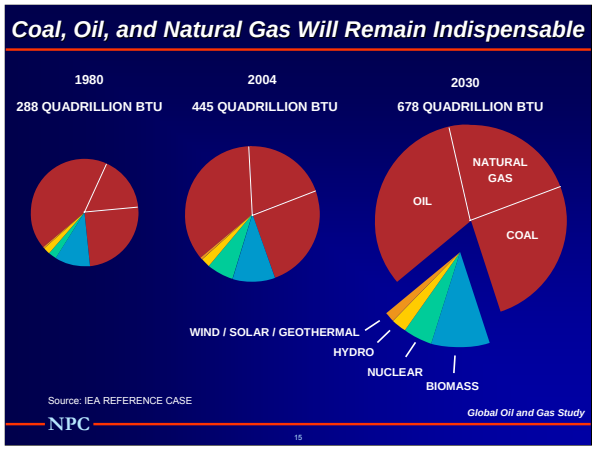


And as incomes rise so does demand for energy. The reference case projections for world energy demand show roughly a 50-60 percent increase in demand from 2005 to 2030. Very soon, and for the first time in history, non-OECD energy demand will exceed OECD energy demand. This has geopolitical implications as well which you will hear about later.



There is a wide range of expectations about future energy demand levels. These outlooks are from the United States Energy Information Administration and the International Energy Agency (a cooperative grouping of most OECD members) . These projections show significant long-term growth in energy demand. Even at the low end of these projections there is still a 34 percent increase in global energy demand to 2030. In volume terms that represents a gain in global demand that is in excess of what the U.S. currently consumes. So even at the low end significant growth.

For some more context about what this means in terms of energy demand, if you look at oil and take a mid-range case for oil, in 2030 the world could be consuming about 57,000 gallons of oil per second.



This is the IEA reference case outlook which is generally indicative of most of the outlooks that we reviewed. We have seen significant growth in non-fossil fuel energy sources and more is projected. Although the share of non-fossil fuels is growing rapidly, fossil fuels will continue to play a significant role through 2030. This is the hard truth about demand that fossil fuels are indispensable to satisfy demand as global prosperity and incomes increase.

The Hard Truth - Supply

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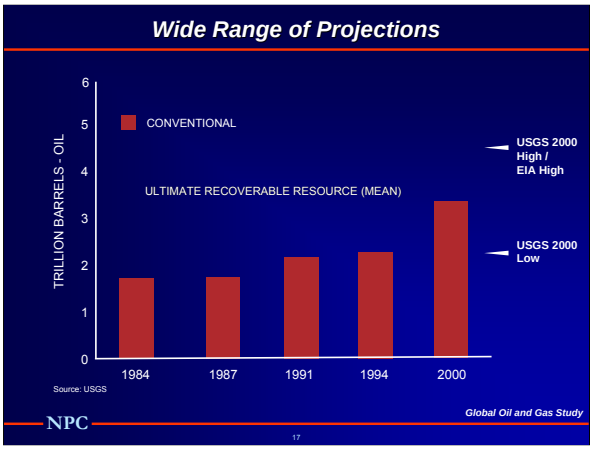


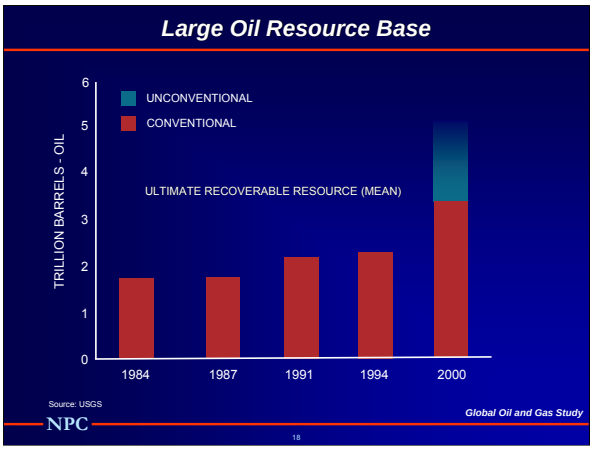
These are historic assessments of ultimate recoverable resources for oil from the U.S. Geological Survey .

Note that these estimates increase over time. This is due to changes in methodology, increases in geological knowledge and data, as well as advances in technology. As you look at this ultimate recoverable resource, just over one trillion barrels of it has been produced to date.

(🖱)

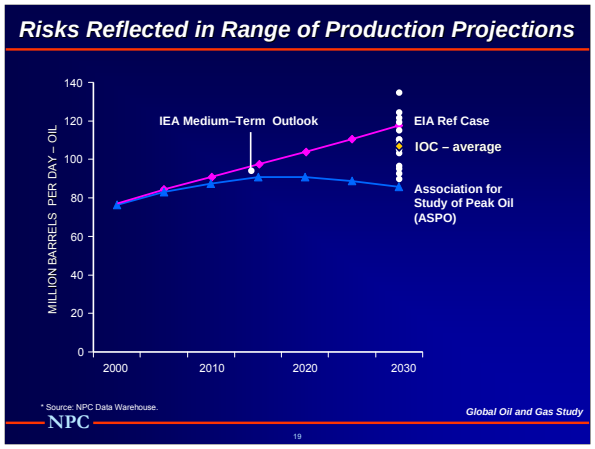
Here are two alternative assessments (refer to graph), a high and a low. The difference between these estimates of conventional recoverable resource base is significant because varying resource estimates can lead to different oil production forecasts.

(🖱) *<to disappear the high and low labels>*



Additionally, the USGS 2000 survey added a view of unconventional resources, shown in blue, which expand the overall resource base. These resources, which include tar sands and oil shale, possess uncertainties and challenges of their own.

Coal and biomass resources are not illustrated here, but were included in the study and represent significant potential sources of power and liquid fuel.



The forecasts of total global liquids production to 2030 include a broad range of views. This range spans from 80 million barrels per day to more than 130 million barrels The study team collected data from a diverse set of sources including : integrated forecasts from the IEA and EIA; other publicly available sources such as ASPO

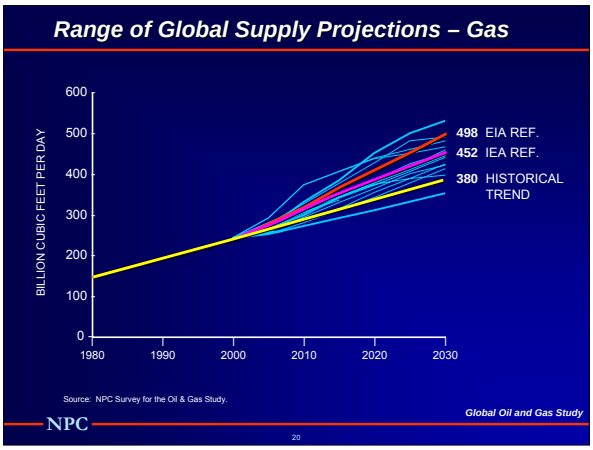
(🖱) and aggregated proprietary data from international energy companies and consultants.

This range reflects different assumptions about :

1. Decline rates in the existing production base.
2. Risks in the current reserve estimates and their conversion to production.
3. Technology and the role it will play to enhance recovery from existing fields.
4. The rate and timing of major investments
5. The timing and scale of new discoveries
6. The role that unconventional fuels play in meeting the overall liquid production

Aggregated proprietary data gathered from the International Energy Companies provided a unique perspective in this study. (🖱)The IOC average of 107 MBD falls below the EIA reference case - by about 10 million barrels a day. Or to put that in perspective about equivalent to the current production of Saudi Arabia.

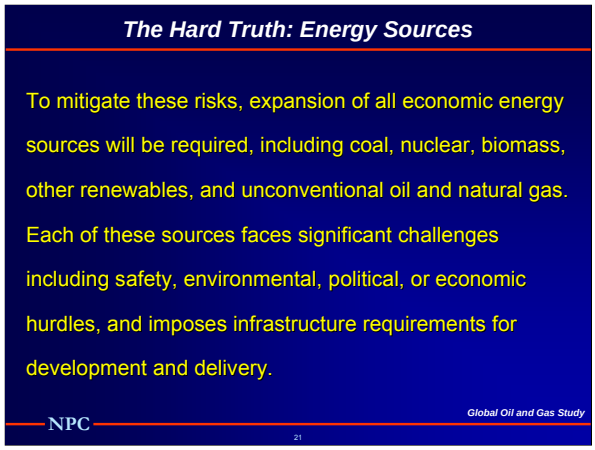
Memo: The IEA 2012 projection falls in the middle of the projections (🖱)



Like oil, natural gas has a broad range of supply projections. The majority of forecasts lie above the yellow historical trend line. These forecasts and the estimated resource base indicate that we can meet future demand to 2030.

Two key aspects emerge :

1. To meet these mid-range forecasts we will consume approximately 50 percent of the existing proved reserve base. The implication is, a significant amount of additional discovery and development needs to take place to replace those reserves.
2. Unlike the case with oil, gas is less developed on a global scale. The amount of infrastructure that must be added on a global basis, pipelines, LNG, et cetera, is significant and massive.



This leads us to a second hard truth about energy sources.

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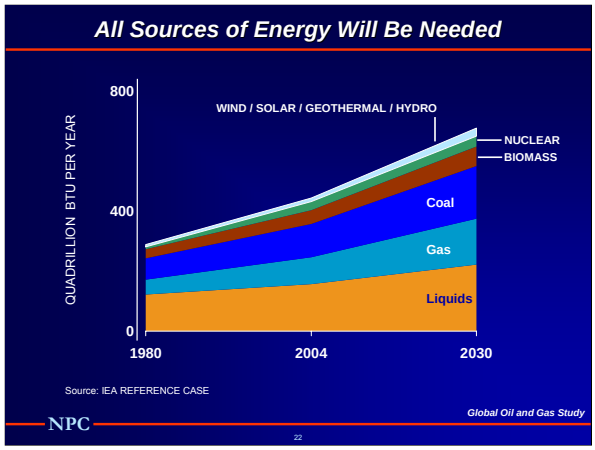
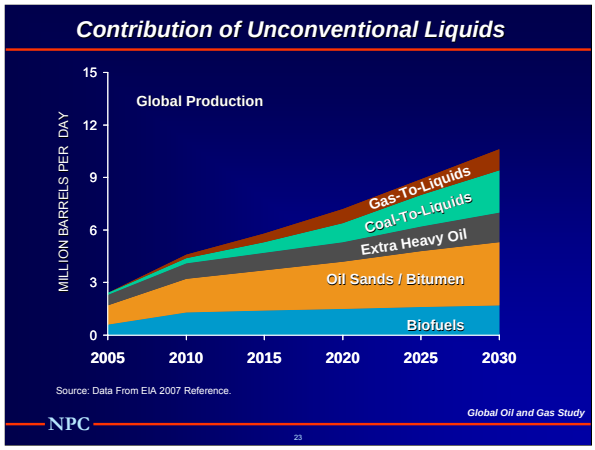


You've seen this data before in the demand section. This is a different representation.

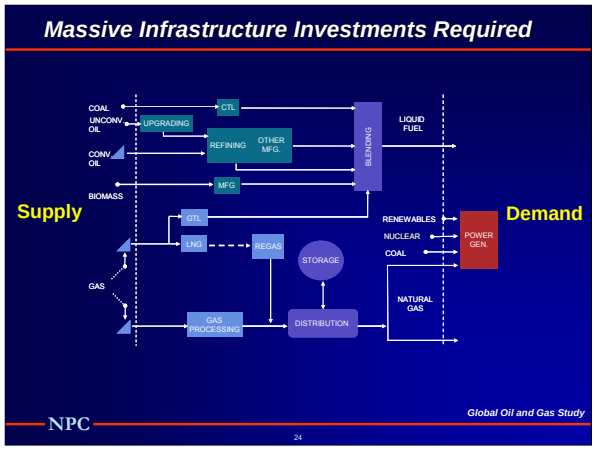
The key message is , whether it's petroleum, gas, coal, or other sources of energy, we are going to need them all. Given the anticipated and projected demand rates, no one segment can be missing in order to meet them.



Let's turn to unconventional liquids and the important contribution to be made in this area.

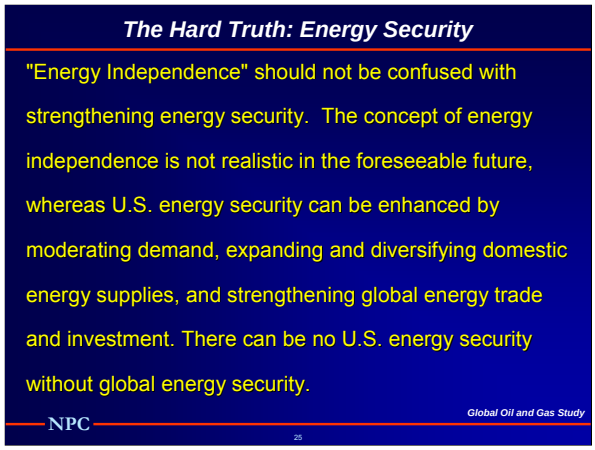
The EIA reference case projects approximately 9.5 million barrels a day from what they call "unconventional liquids." One of the significant differences across the spectrum of forecasts relates to the assumptions about timing and investment in these unconventional fuels.

We have prepared detailed topic papers which assess each of these alternatives.



A large and complex infrastructure including transportation, storage, manufacturing, and distribution will be required to support future growth. Infrastructure is not accounted for in many forecasts, including integrated outlooks

**(**)The combination of significant growth in supply, geographic shifts in demand centers, and the growth of unconventional resources, all points to a need for massive infrastructure investment. Estimates about energy infrastructure investment suggest around $20 trillion will be required over the coming decades.



Hard Truth – Energy Security

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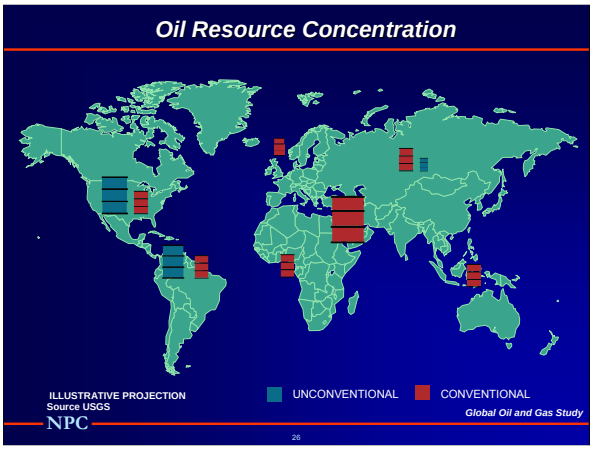


Oil Resource Concentration – conventional

Many of the risks to energy security are "above ground," for example, the geographic distribution of resources.

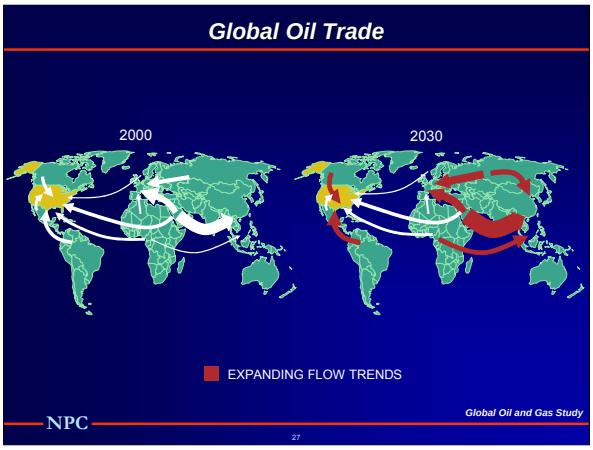
As conventional oil production in traditional areas, such as in North America, continues to decline, available resources will be increasingly concentrated in regions like the Middle East and the former Soviet Union.

Thus, not only will incremental oil demand come from emerging economies, as was shown earlier, conventional oil production will also shift increasingly to a few major oil producing countries.

(🖱)

If we add unconventional resources – such as oil sands, bitumen or oil shale – to the picture, the situation improves for North and South America.

However, increasing unconventional production at scale requires long lead times and carries its own challenges.



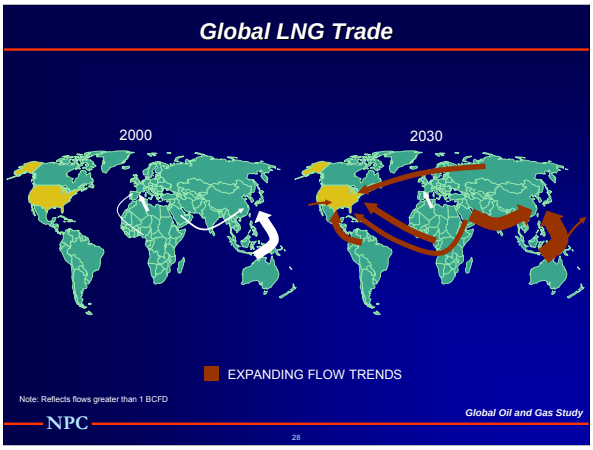
Global Oil Flows

Shifting demand and supply patterns will lead to shifting flows of oil and gas.

If we compare oil flows today *to* what it might look like by 2030, (🖱) a lot more long-haul cargoes will be shipped out of the Persian Gulf, Russia and the Caspian region.

The shift in demand and supply also raises the question of whether the rules of the international oil game will change, *or* indeed have already started to change, with *market-driven* trade and investment no longer a lofty, universally-held, objective.

Issues like resource nationalism that limit *access* for development by the international industry has taken on renewed importance.

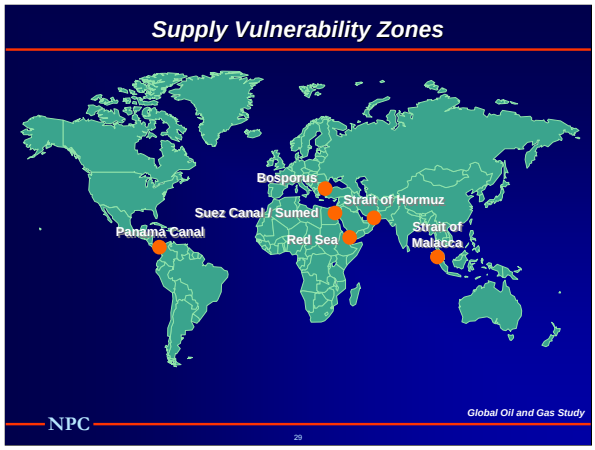


Global LNG Flows

The contrast is even more dramatic in the case of gas, with a big jump in long-haul inter-regional gas flows.

If we look at what future liquefied natural gas flows might look like, tanker movements will increase greatly from producing areas to the U.S. and major consumers in East Asia.

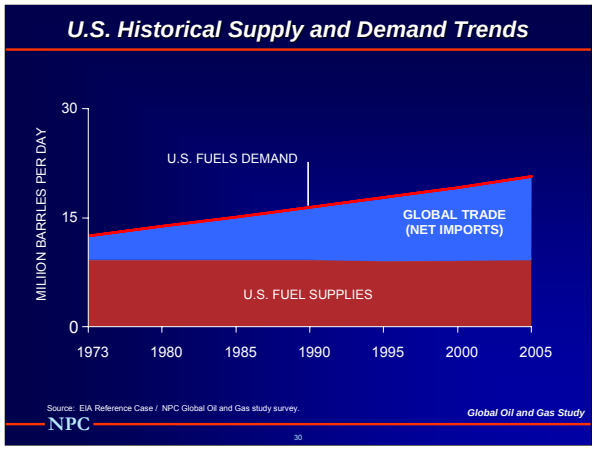
This illustrates further the challenges of building massive new infrastructure for liquefaction, transportation, receiving and re-gasification.



Supply Vulnerability Zones

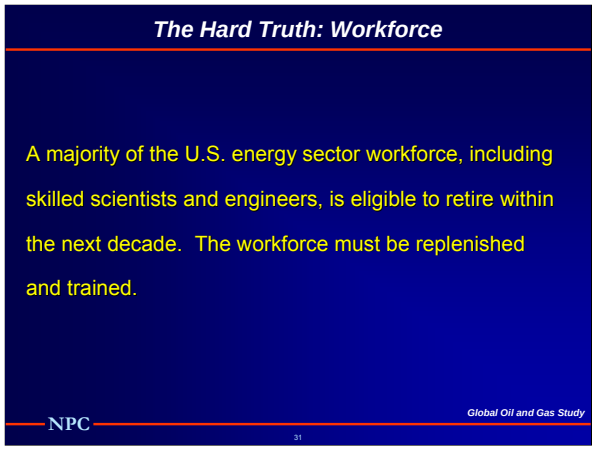
More than half of international oil movements go through half a dozen choke points today.

This vulnerability will likely increase over time.



U.S. Historical Supply and Demand Trends

Net U.S. imports have grown in the last thirty years with domestic consumption outpacing growth in domestic supply. Without changes, this trend is likely to continue.



Hard Truth – Workforce

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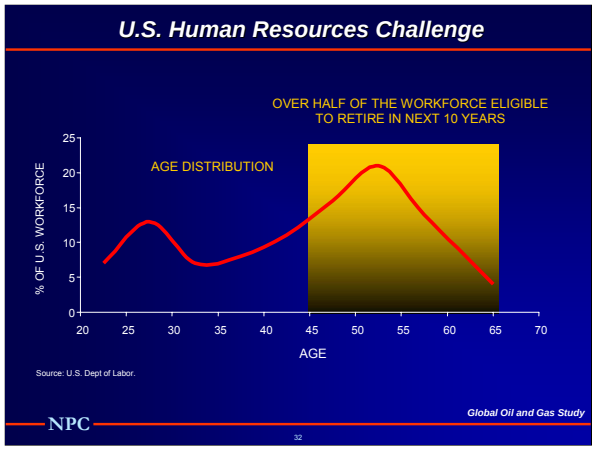
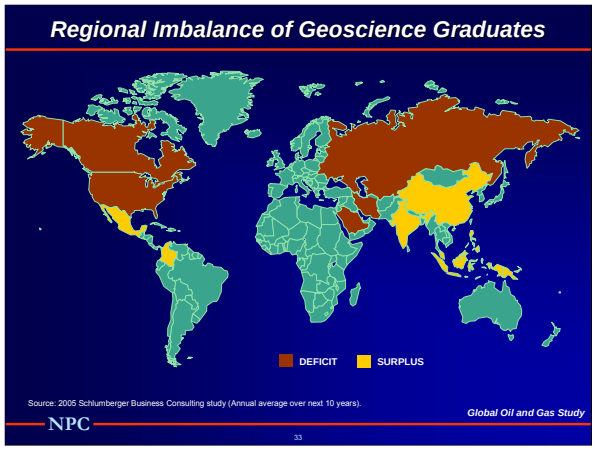


The oil industry experienced a hiring surge in the late 70's and early 80's followed by an extended period of decline resulting in the peak evident in this age distribution.

A recent influx of new talent has not made up for decades of depressed hiring activity. As a result, over half of today's workforce is eligible for retirement within the next 10 years – often referred to as "the big crew change".

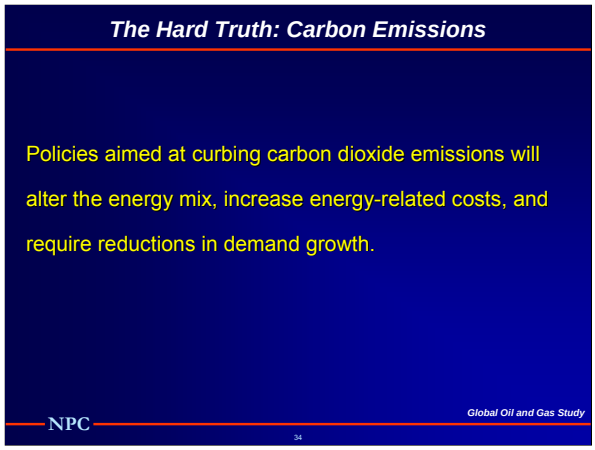
The workforce must be replenished, but this challenge is exacerbated by an overall shortage of science and engineering graduates, particularly women and minorities. Additional challenges include the industry's image and competition from other industries.



This issue is not exclusive to the US.

This map depicts one calculation of the net deficit or surplus of geoscience graduates by country for the next ten years. Countries in green have limited data or are in balance.

The US could fill its deficit by importing talent but we will be in competition with other countries who face similar needs, and immigration policies would have to be revisited.



Hard Truth – Carbon Emissions

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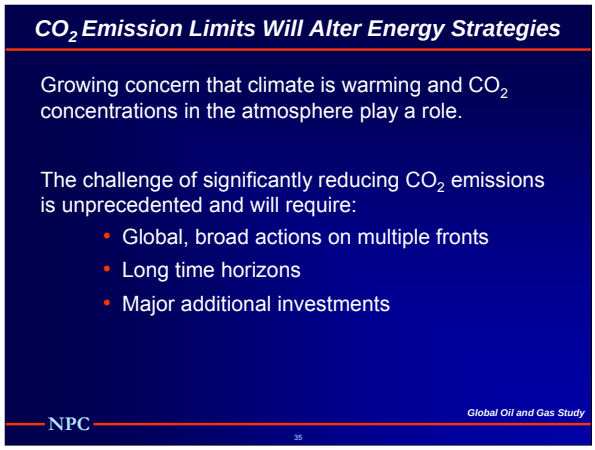


Carbon dioxide emissions from continuing use of fossil fuels are a growing concern.

We took a pragmatic approach to carbon management, including technical, environmental and regulatory considerations with the help of a distinguished team of diverse experts *from within and outside the oil & gas industry*

Several factors combine to make this a long term and global challenge, including the fact that atmospheric concentrations are :

- cumulative,
- long lasting and
- don't conform for geographic boundaries.

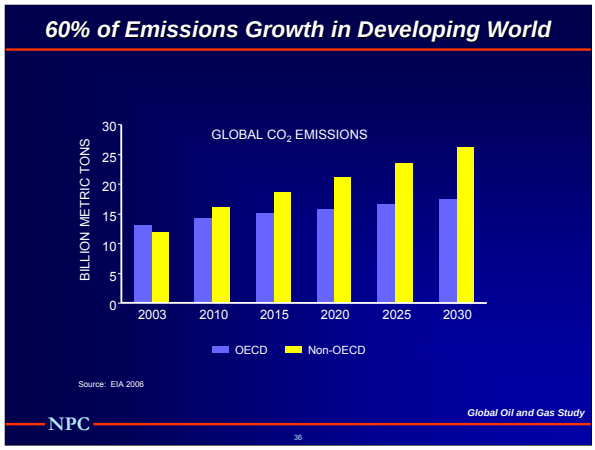
The scale and complexity of the challenge to meaningfully reduce carbon emissions is daunting.

To put it in perspective:

The US currently emits 6.3 billion tons of CO2, or 115 lbs per person per day, or 20 times the daily solid waste of an average person.

In terms of sequestration volumes, one 1 GW coal fired power plant produces 150,000 bbls of liquefied CO2 per day.

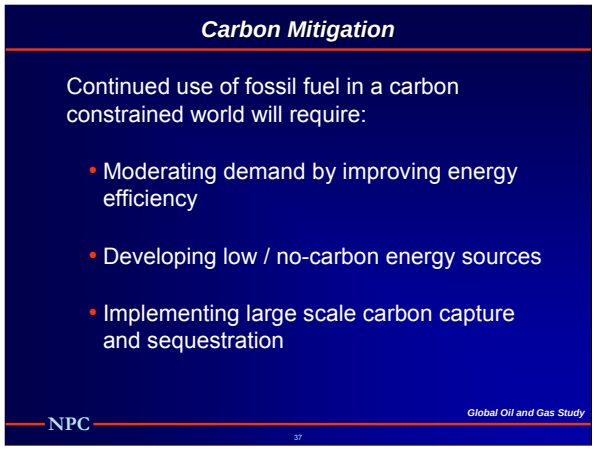
It is a significant challenge, but the industry is used to overcoming challenges and we handle these kinds of volumes every day.



Energy demand growth is accelerating in the developing world and CO_2 emissions follow.

In addition, the energy mix in these geographies includes a higher concentration of fossil fuels.

The US and China together make up about 40% of the world's total CO_2 emissions going forward. This points to a global issue requiring global solutions.



While addressing carbon concerns, we need to enable the continued use of fossil fuels.

A carbon constrained world requires that we :

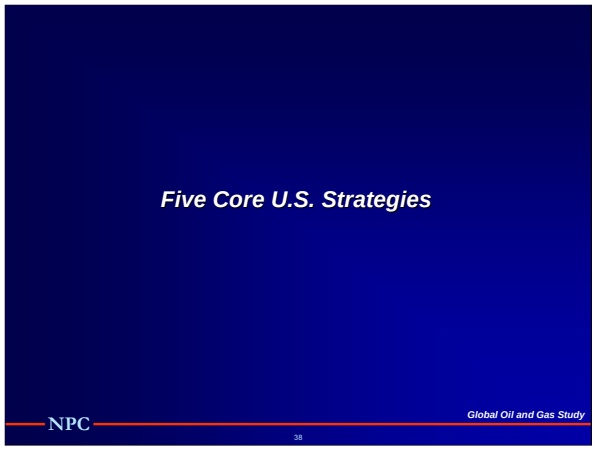
•Moderate demand by improving energy efficiency across the transportation, industrial and commercial sectors

(🖱)

•Accelerate development of low carbon energy

(🖱)

•And finally, implement *large* scale carbon capture and sequestration at large point sources, something the oil and gas industry is well suited to implement



So you have heard a brief summary about our findings - the hard truths. Considerable analysis supports these findings and can be found in the detailed study and topic papers.

Everyone is concerned about energy - its availability, reliability, cost and environmental impact. To address these concerns, the study team proposes five core strategies to assist markets in meeting the energy challenges to 2030 and beyond. All five are essential and we are confident that the prompt adoption of these strategies, along with a sustained commitment to implementation, will promote US competitiveness by balancing economic, security and environmental goals.

The strategies are as follows:

(🖱)Moderate Demand By Increasing Energy Efficiency

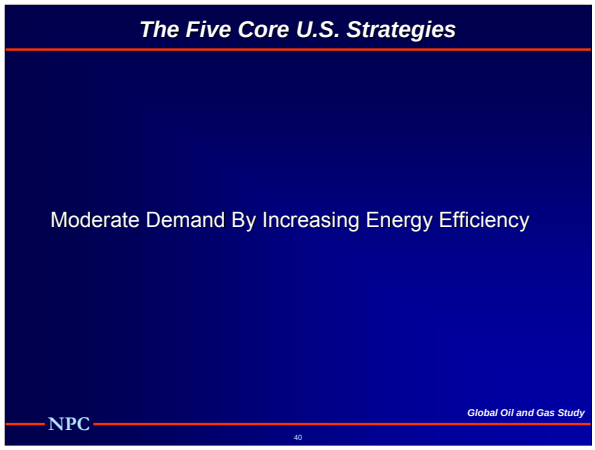
(🖱) Expand And Diversify U.S. Energy Supply

(🖱) Strengthen Global And U.S. Energy Security

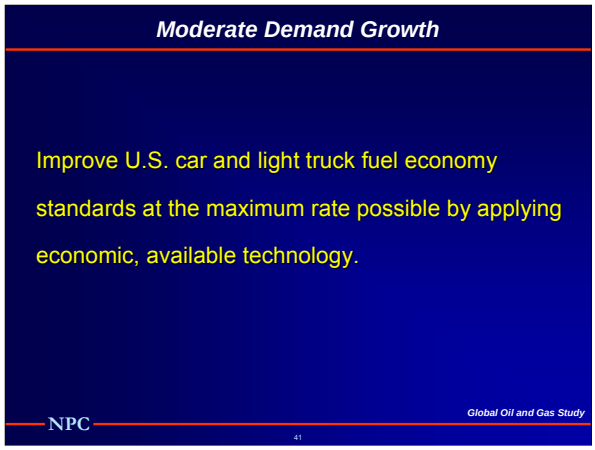
(🖱) Reinforce Capabilities To Meet New Challenges

(🖱) Address Carbon Constraints

(🖱) All of these strategies will be essential - there is no easy solution to the multiple challenges we face.

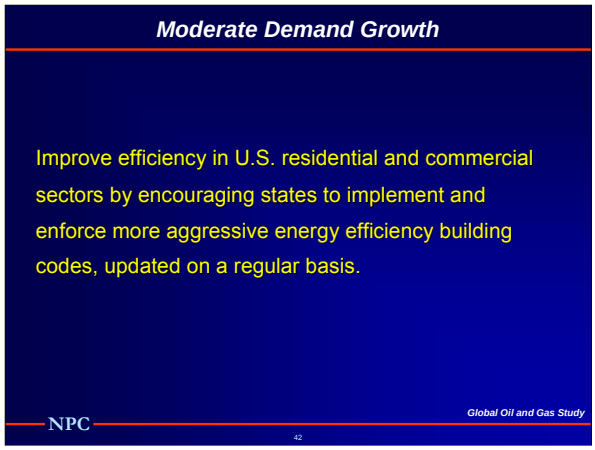


For moderating demand there are three pillars that support the objective.



Just under half of the 21 million barrels per day of oil that the U.S. consumes each day is used by light-duty vehicles. The first pillar is to improve the fuel efficiency of cars and light trucks.

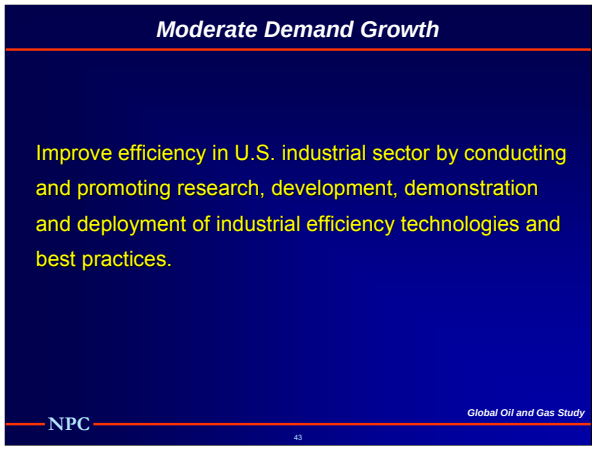
The potential impact of a doubling of new vehicle fuel economy by 2030 is fuel savings of three to five million barrels per day. Of our demand recommendations this one has the biggest potential energy savings.



The second pillar is to improve efficiency in the U.S. residential and commercial sectors which consume about 40 percent of U.S. energy. There are three steps to achieving this.

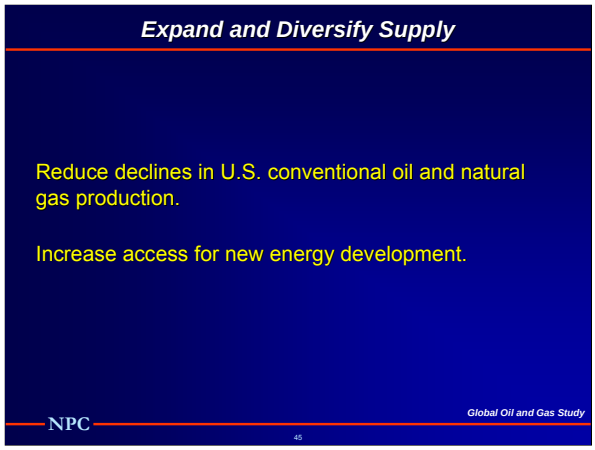
1. Update building codes to reflect cost effective energy building technologies that have outpaced US government standards.
2. Enforce these building codes to ensure that all new buildings comply with updated energy code requirements.
3. Develop new energy efficiency standards for appliances, such as digital products, not currently covered.

The potential energy savings of implementing these steps in the U.S. residential and commercial sector are seven to nine quadrillion BTU's.



The third pillar is to improve efficiency in the U.S. industrial sector, which consumes about one-third of U.S. energy. Across the industrial sector there are opportunities to increase energy efficiency by about 15 percent. The potential savings are four to seven quadrillion Btu's by 2030, about equal parts coal, gas and oil. Efficient energy use is essential for U.S. manufacturers to remain internationally competitive.

Let’s move on to Supply and discuss the core strategies to expand and diversify U.S. energy supply.



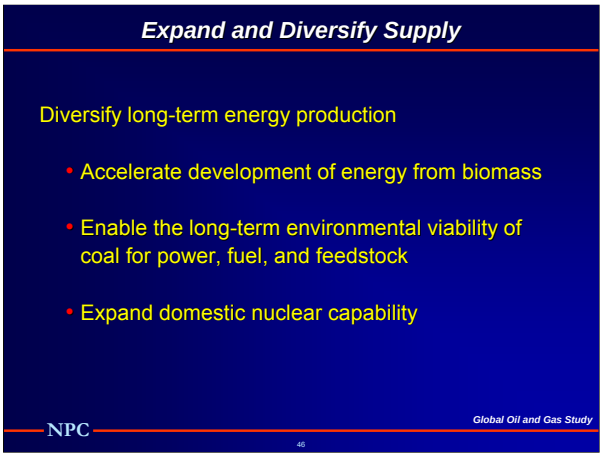
The first recommendation to reduce the declines in the conventional U.S. oil and gas production. The U.S. is the largest historical producer of oil and gas and remains the third largest producer in the world. All efforts to retain the U.S. conventional production base will contribute significantly to stable supply.

For example:

1. Applying enhanced oil recovery techniques to recover more hydrocarbons from the existing resource base.
2. Maintaining production from marginal wells which contribute around 17% of total US production

In addition, access should be expanded to the most favorable oil and natural gas basins. To support this goal:

1. Conduct national and regional oriented resource and market assessments to identify biggest opportunities
2. Use technology and operational advancements to allow environmentally responsible development



The United States has unique and material unconventional resources. One of them is biomass. The study recommends the accelerated development of biomass including technology for growing and converting energy crops, and developing the infrastructure required to bring biofuels to market.

(🖱)

The second unique resource is coal. The U.S. is one of the world's largest coal producers and has, by some measures, the largest reserve base. Most projections indicate that coal will contribute substantially in the long term to power generation and fuel production. To do this, coal must be environmentally viable and carbon management must be addressed.

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Turning to nuclear, the study recommends reestablishing US historic technical leadership. Although the study does not specifically recommend construction of new nuclear facilities, it is likely that nuclear energy will play a role in a carbon constrained world. Reestablishing technical and industrial capability preserves the option to include nuclear in the future energy mix.

Strategy – Strengthen global and U.S. energy security

As we said before, we *cannot* separate U.S. energy security from global energy security.

The *inter*dependent nature of this relationship was demonstrated in the aftermath of Hurricanes Katrina and Rita, when international markets responded to the temporary disruption in domestic production and distribution . This demonstrated that both the U.S. and the world depend on the stability and reliability of the international energy system.

Promote Global and U.S. Energy Security

Therefore, the U.S. should elevate our energy policy goals to the same level as traditional security, foreign and trade policy objective.

This approach will mitigate the risk of unintended consequences from other policies that might impact energy, and will take advantage of opportunities to advance energy security.

Promote Global and U.S. Energy Security

As the world's largest energy consumer and *ourselves* a major producer of oil, natural gas and coal, the U.S. is uniquely positioned to lead the dialogue between major producing and consumer countries…

For the purpose of seeking common ground to protect the legitimate interests of both sides.

Promote Global and U.S. Energy Security

An important part of that dialogue should promote market transparency, and encourage open trade and investment in energy.

Given the long lead time and large capital requirements of the energy industry, one of the major uncertainties for large investments to go forward is the stability of the international energy system.

Promote global and U.S. energy Security

Another area where the U.S. can play a natural leadership role is in energy efficiency and the speedy adoption of new technologies…especially in developing countries and emerging economies, where so much of demand growth is projected.


The Five Core U.S. Strategies
Reinforce Capabilities To Meet New Challenges
Global Oil and Gas Study
NPC
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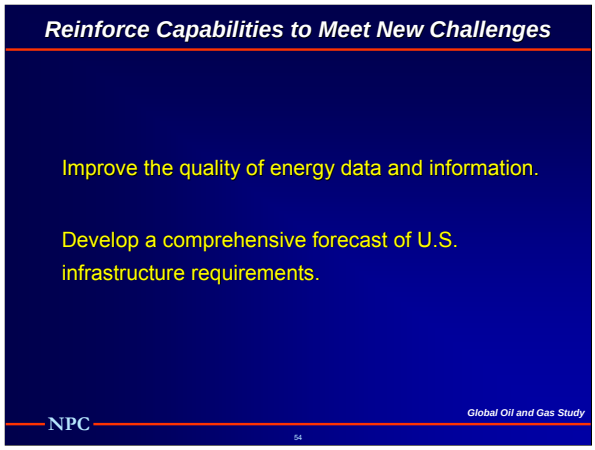
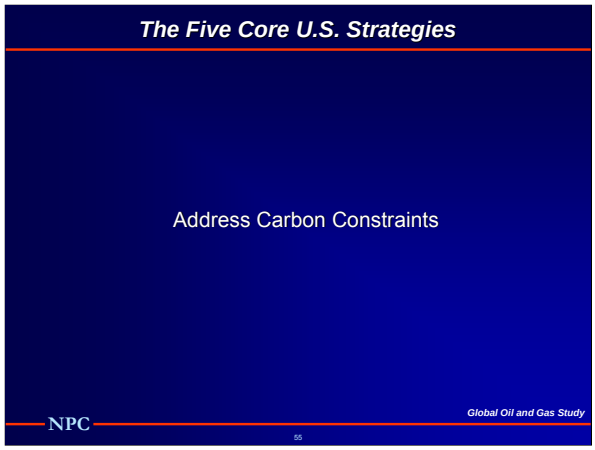
US competitiveness in the future will be enhanced if we re establish US leadership in science and engineering education

The creation of research opportunities for US universities and national labs will reinforce our capability and leadership

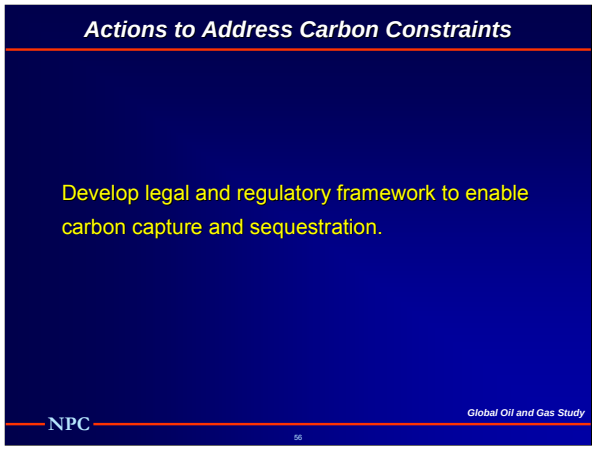


The scarcity of the data from which parties make recommendations fuels diversity of opinion. On the supply side, for example, the USGS should take the lead in *developing a new inventory of global endowment including unconventional resources*

Infrastructure, a critical piece of the energy chain, has historically been neglected and we can no longer afford to do so. A concerted effort to forecast future infrastructure needs is critical to the US particularly with respect to electrical demand and alternative fuels.

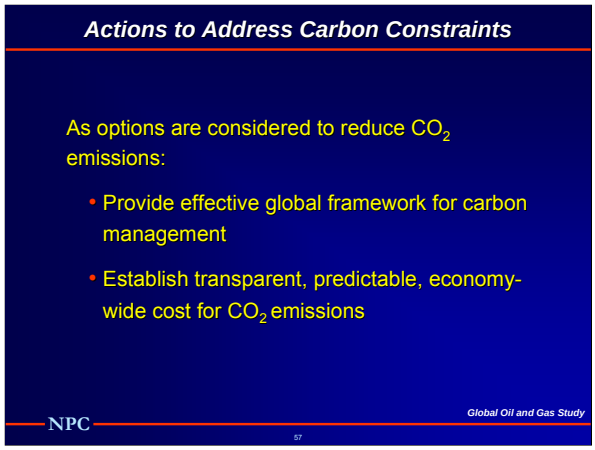


Lastly, let’s address carbon constraints.



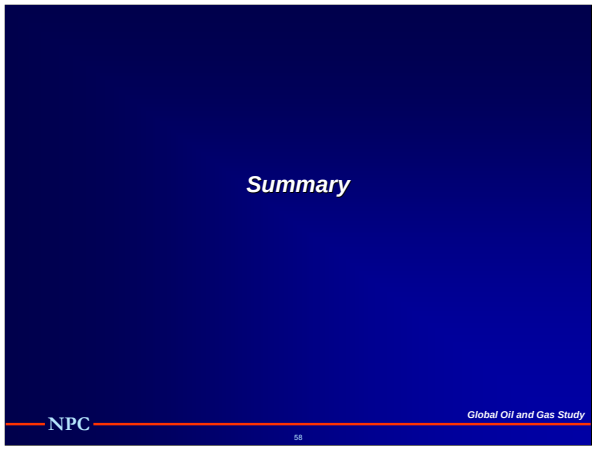
The biggest hurdle to implementing carbon capture and sequestration is the lack of a clearly defined legal and regulatory framework.

This hurdle must be removed as soon as possible to allow industry to go to work.



Reducing CO_2 emissions is a long term, global issue and must be dealt with as such. It is also an opportunity for US leadership.

A transparent, predictable, economy wide cost (price) for CO_2 emissions will allow the market to find the most efficient means of addressing this complex challenge.

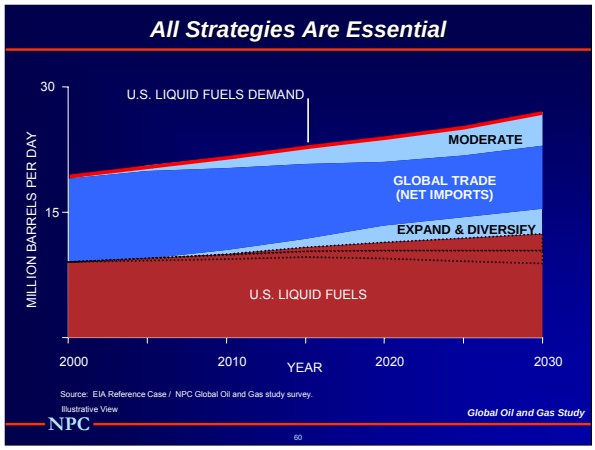


Let’s wrap up now with a few summary comments.

All five of the strategies you have just heard described, must be addressed together to meet tomorrow's energy challenges.

Global cooperation will be required with the US playing a leading role.

Actions must begin now and be sustained over the long term.



I'd like to close this presentation by providing an illustration of the potential effects of implementing the recommended NPC strategies. Using the latest EIA reference case as a start point, liquid fuels demand is projected to grow to around 25 MBD by the year 2030.

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On the supply side, domestic production of liquid fuels also grows as unconventional fuels, including biofuels, offset the decline in domestic conventional production. As you can see, the gap between domestic supply and demand is still growing. Bridging that gap relies upon US interaction with global markets.

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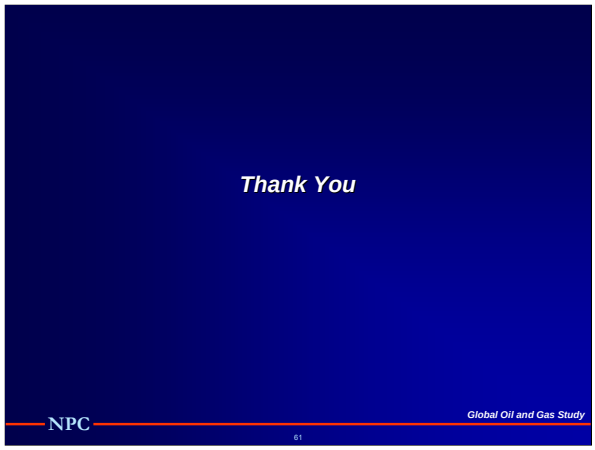
Implementing the NPC recommended strategies will have a dramatic impact on this outlook. Demand moderation reduces the slope of the upper curve, as requirements are reduced. On the other hand, moderating the decline of conventional supplies, and further expanding and diversifying domestic sources, will change the lower curve. The combined effect of the strategies will reduce the gap between domestic supply and demand by about one third over the time period - improving the outlook for energy availability , reliability , cost and environmental impact.



We believe that our report provides a fair and balanced view of the challenges facing the world's integrated energy system. We hope that the findings and recommendations will stimulate continued discussions, and encourage policy makers to find common areas of agreement in meeting our energy challenges.

Thank you for listening to this presentation on:
"Facing the Hard Truths About Energy"

For information, please refer to the NPC Website for a complete list of available resources:
http://www.npc.org
Send your follow-up questions and comments to:
comments@npc.org