Facing The Hard Truths About Energy

A Comprehensive View To 2030
Of Global Oil And Natural Gas

July 18, 2007
Today’s Discussion

- Study Approach

- What We Learned: The Hard Truths

- Recommended Strategies For The U.S.
The Secretary’s Suggested Questions

- What does the future hold for global oil and natural gas supply?

- Can incremental oil and gas supplies be brought on-line, on time, and at a reasonable price to meet future demand without jeopardizing economic growth?

- What oil and gas supply and / or demand-side strategies does the Council recommend the U.S. pursue to ensure greater economic stability and prosperity?
How This Study is Different

65% participants from outside of oil and gas industry

350 + participants, plus input from 1000 + others
How This Study Is Different

- Integrated, In-Depth Analysis
  - Over 100 studies incorporated to include both public and aggregated proprietary outlooks
  - Not another forecast of supply, demand or price

- Diversity of Expertise
  - 350 participants with backgrounds in all aspects of energy including efficiency, economics, geopolitics, environment

- Technology Assessment
  - Identified achievable opportunities and likely deployment timing
  - Looked across the energy spectrum, including both supply and demand
Technology Assessment Depth

- Technology Development
- Personnel Issues: The Big Crew Change
- Carbon Management
- Conventional Resources (includes EOR and Arctic)
- Exploration Technology
- Deepwater Technology
- Unconventional Gas (including Coal and Shale gas)
- Heavy Oil and Bitumen
- Oil Shale
- Gas Hydrates
- Coal to Liquids and Gas
- Biomass fuels
- Nuclear Outlook and impact on Oil and Gas demand
- Transportation Efficiency
- Other Renewables

- Time horizons
- Research budgets
- Human resources
- Deployment
The Hard Truths ....

Demand
Supply
Energy Sources
Energy Security
Workforce
Carbon Emissions
What We Learned:
The Hard Truths
Coal, oil, and natural gas will remain indispensable to meeting total projected energy demand growth.
Economic Growth Patterns Are Shifting

Global GDP
2006 / 2030 ~ $ 40 / 80 Trillion

Economic Growth Patterns Are Shifting

North America
Europe
Russia/Caspian
Middle East
Asia Pacific
Latin America
Africa

2006
2030

Global GDP
2006 / 2030 ~ $ 40 / 80 Trillion

ILLAISTRATIVE PROJECTION
Source EIA, IEA & Other Outlooks

Global Oil and Gas Study

NPC
Range of Projections Point to Growing Demand

TOTAL ENERGY

QUADRILLION BTU PER YEAR

0

EIA HIGH
EIA REF
IEA REF
IEA ALT POLICY
EIA LOW

Global Oil and Gas Study
Coal, Oil, and Natural Gas Will Remain Indispensable

1980
288 QUADRILLION BTU

2004
445 QUADRILLION BTU

2030
678 QUADRILLION BTU

Source: IEA REFERENCE CASE

Global Oil and Gas Study
The world is not running out of energy resources, but there are accumulating risks to continuing expansion of oil and natural gas production from the conventional sources relied upon historically. These risks create significant challenges to meeting projected total energy demand.
Wide Range of Projections

ULTIMATE RECOVERABLE RESOURCE (MEAN)

TRILLION BARRELS - OIL

Source: USGS

Global Oil and Gas Study
**Risks Reflected in Range of Production Projections**

* Source: NPC Data Warehouse.

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**Global Oil and Gas Study**
Range of Global Supply Projections – Gas

Source: NPC Survey for the Oil & Gas Study.
To mitigate these risks, expansion of all economic energy sources will be required, including coal, nuclear, biomass, other renewables, and unconventional oil and natural gas. Each of these sources faces significant challenges including safety, environmental, political, or economic hurdles, and imposes infrastructure requirements for development and delivery.
All Sources of Energy Will Be Needed

Source: IEA REFERENCE CASE

Global Oil and Gas Study
Contribution of Unconventional Liquids

Global Production

MILLION BARRELS PER DAY

Source: Data From EIA 2007 Reference.

Global Oil and Gas Study
Massive Infrastructure Investments Required

Supply

- COAL
- UNCONV. OIL
- CONV. OIL
- BIOMASS
- GAS

Demand

- POWER GEN.
- NUCLEAR
- COAL
- NATURAL GAS

Processes:
- GTL
- LNG
- REGAS
- PROCESSING
- STORAGE
- DISTRIBUTION
- UPGRADE

Global Oil and Gas Study
"Energy Independence" should not be confused with strengthening energy security. The concept of energy independence is not realistic in the foreseeable future, whereas U.S. energy security can be enhanced by moderating demand, expanding and diversifying domestic energy supplies, and strengthening global energy trade and investment. There can be no U.S. energy security without global energy security.
Oil Resource Concentration

ILLUSTRATIVE PROJECTION
Source USGS

UNCONVENTIONAL
CONVENTIONAL

Global Oil and Gas Study
Global Oil Trade

2000

2030

EXPANDING FLOW TRENDS

Global Oil and Gas Study
Global LNG Trade

EXPANDING FLOW TRENDS

Note: Reflects flows greater than 1 BCFD

Global Oil and Gas Study

2000

2030
Supply Vulnerability Zones

Global Oil and Gas Study
U.S. Historical Supply and Demand Trends

U.S. FUELS DEMAND

GLOBAL TRADE (NET IMPORTS)

U.S. FUEL SUPPLIES

Source: EIA Reference Case / NPC Global Oil and Gas study survey.

Global Oil and Gas Study
A majority of the U.S. energy sector workforce, including skilled scientists and engineers, is eligible to retire within the next decade. The workforce must be replenished and trained.
U.S. Human Resources Challenge

Over half of the workforce eligible to retire in next 10 years

Source: U.S. Dept of Labor.
Regional Imbalance of Geoscience Graduates

Source: 2005 Schlumberger Business Consulting study (Annual average over next 10 years).
Policies aimed at curbing carbon dioxide emissions will alter the energy mix, increase energy-related costs, and require reductions in demand growth.
Growing concern that climate is warming and CO$_2$ concentrations in the atmosphere play a role.

The challenge of significantly reducing CO$_2$ emissions is unprecedented and will require:

- Global, broad actions on multiple fronts
- Long time horizons
- Major additional investments
60% of Emissions Growth in Developing World

GLOBAL CO₂ EMISSIONS

Source: EIA 2006

Global Oil and Gas Study
Carbon Mitigation

Continued use of fossil fuel in a carbon constrained world will require:

- Moderating demand by improving energy efficiency
- Developing low / no-carbon energy sources
- Implementing large scale carbon capture and sequestration
Five Core U.S. Strategies
The Five Core U.S. Strategies

• 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

There Is No Single, Easy Solution
The Five Core U.S. Strategies

Moderate Demand By Increasing Energy Efficiency
Moderate Demand Growth

Improve U.S. car and light truck fuel economy standards at the maximum rate possible by applying economic, available technology.
Moderate Demand Growth

Improve efficiency in U.S. residential and commercial sectors by encouraging states to implement and enforce more aggressive energy efficiency building codes, updated on a regular basis.
Moderate Demand Growth

Improve efficiency in U.S. industrial sector by conducting and promoting research, development, demonstration and deployment of industrial efficiency technologies and best practices.
Expand And Diversify U.S. Energy Supply
Expand and Diversify Supply

Reduce declines in U.S. conventional oil and natural gas production.

Increase access for new energy development.
Expand and Diversify Supply

Diversify long-term energy production

• Accelerate development of energy from biomass

• Enable the long-term environmental viability of coal for power, fuel, and feedstock

• Expand domestic nuclear capability
Strengthen Global And U.S. Energy Security
Integrate energy policy into trade, economic, environmental, security, and foreign policies.
Continue to develop the international energy marketplace by expanding the energy dialog with major producing and consuming nations.
Promote an effective global energy marketplace by sustaining and intensifying efforts to encourage global adoption of transparent, market-based approaches.
Assist and encourage global adoption of energy efficiency technologies through technology transfer programs.
The Five Core U.S. Strategies

Reinforce Capabilities To Meet New Challenges
Rebuild U.S. science and engineering capabilities.

Create research and development opportunities.
Reinforce Capabilities to Meet New Challenges

- Improve the quality of energy data and information.
- Develop a comprehensive forecast of U.S. infrastructure requirements.
The Five Core U.S. Strategies

Address Carbon Constraints
Actions to Address Carbon Constraints

Develop legal and regulatory framework to enable carbon capture and sequestration.
Actions to Address Carbon Constraints

As options are considered to reduce CO$_2$ emissions:

• Provide effective global framework for carbon management

• Establish transparent, predictable, economy-wide cost for CO$_2$ emissions
Summary
There Is No Single, Easy Solution

• All Five Strategies Must Be Addressed Together

• Global Cooperation Required

• Begin Now And Plan For Sustained Commitment
All Strategies Are Essential

Source: EIA Reference Case / NPC Global Oil and Gas study survey.

Illustrative View
Thank You
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