



# Facing The Hard Truths About Energy

**A Comprehensive View To 2030  
Of Global Oil And Natural Gas**

**July 18, 2007**

# *Today's Discussion*

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- Study Approach
- What We Learned : The Hard Truths
- Recommended Strategies For The U.S.

## *The Secretary's Suggested Questions*

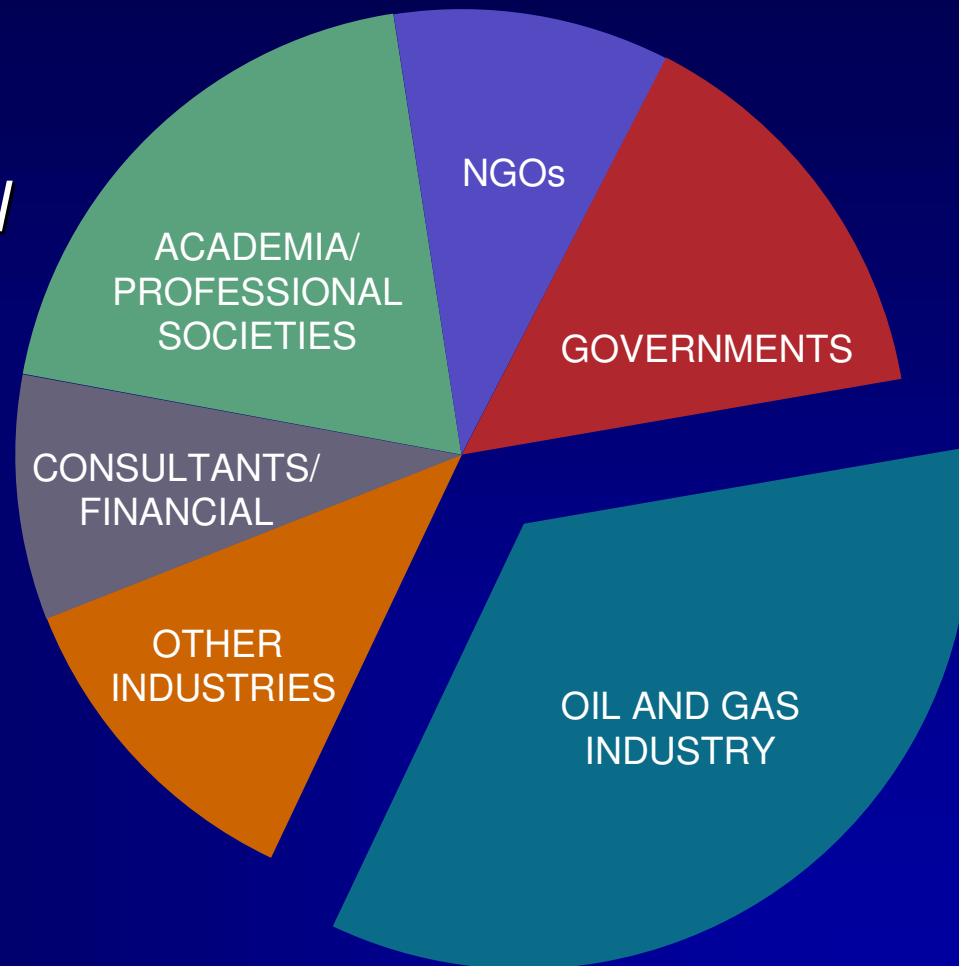
- What does the future hold for global oil and natural gas supply ?
- Can incremental oil and gas supplies be brought on-line, on time, and at a reasonable price to meet future demand without jeopardizing economic growth ?
- What oil and gas supply and / or demand-side strategies does the Council recommend the U.S. pursue to ensure greater economic stability and prosperity ?

# Dimensions of the Study



# 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 ....*

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Demand

Supply

Energy Sources

Energy Security

Workforce

Carbon Emissions

# ***What We Learned: The Hard Truths***

## *The Hard Truth: Demand*

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Coal, oil, and natural gas will remain indispensable to meeting total projected energy demand growth.

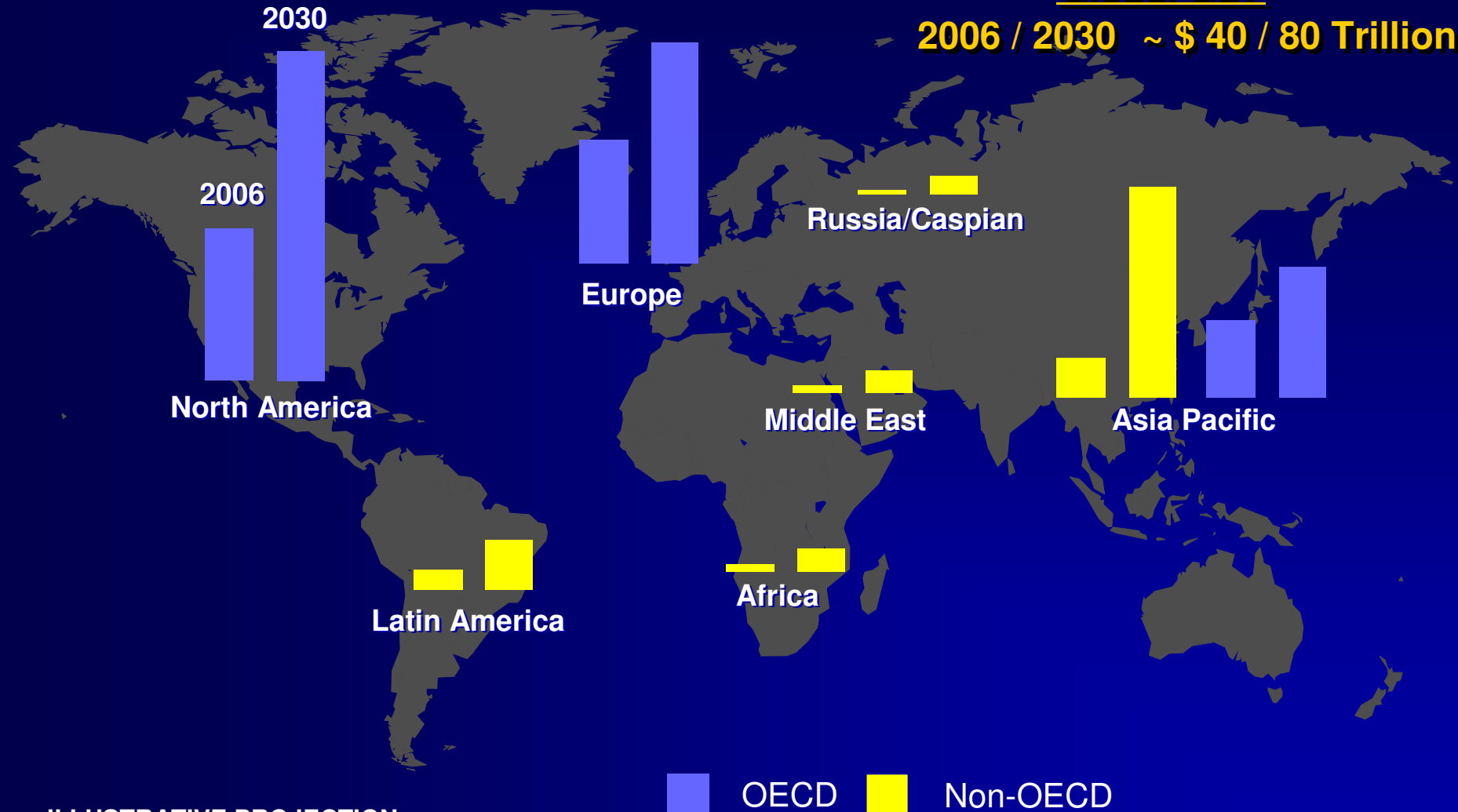
# OECD and Non-OECD Countries



# Economic Growth Patterns Are Shifting

## Global GDP

2006 / 2030 ~ \$ 40 / 80 Trillion



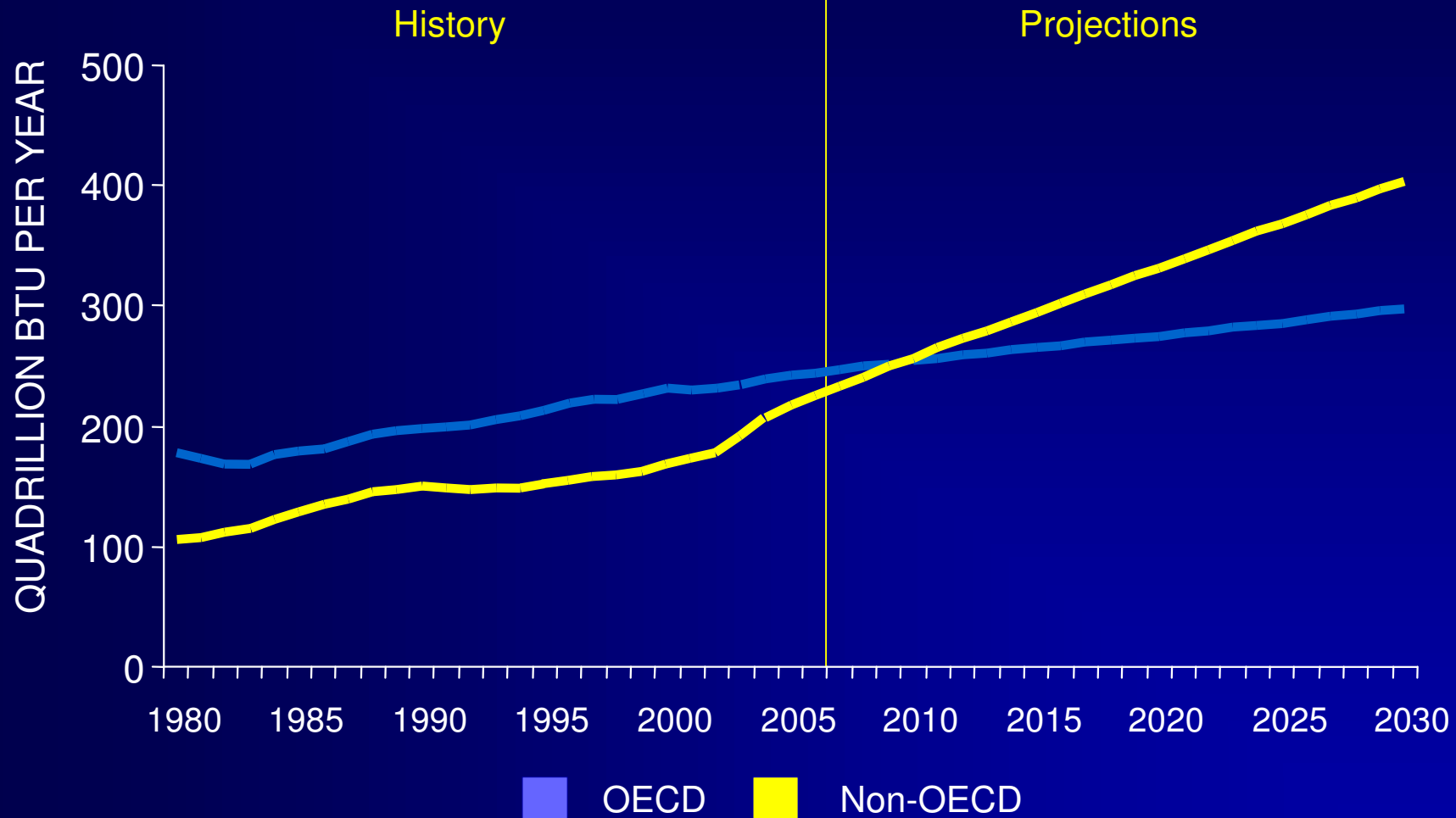
ILLUSTRATIVE PROJECTION

Source EIA, IEA & Other Outlooks

**NPC**

Global Oil and Gas Study

# ... And Energy Demand Growth Follows



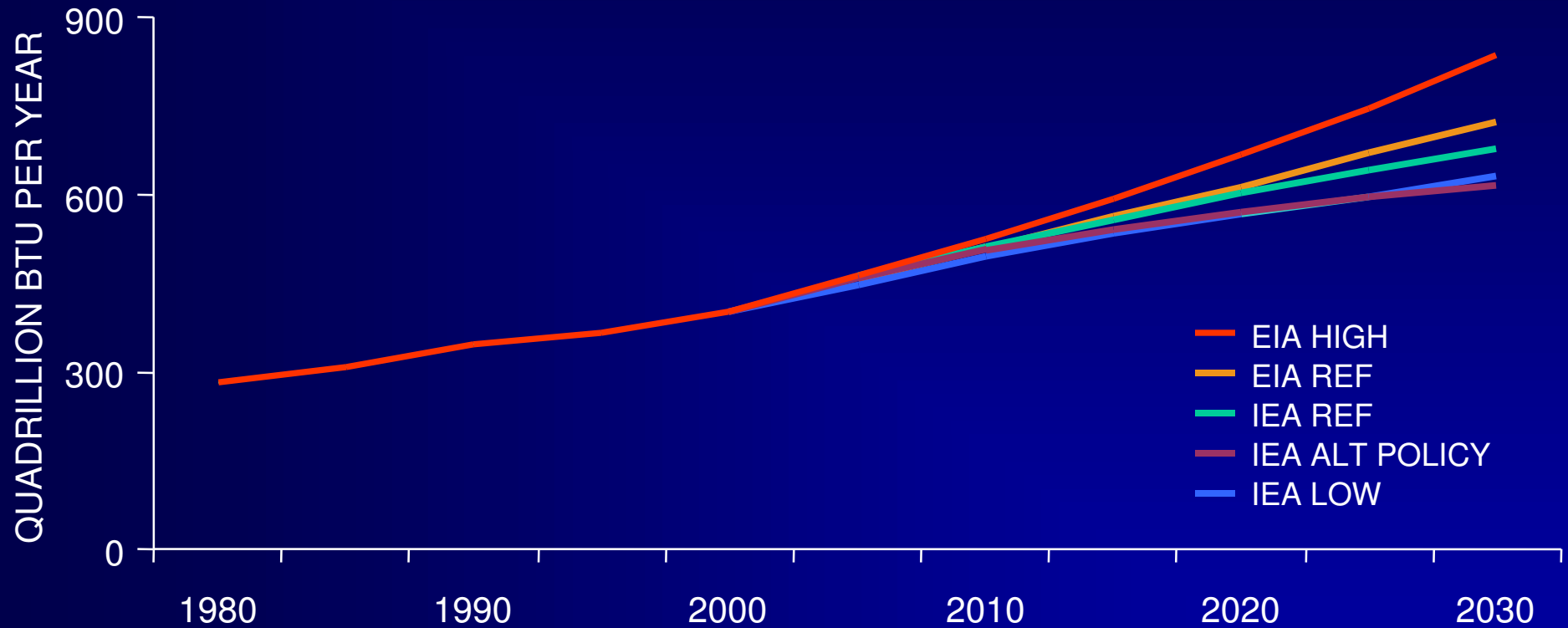
Source: EIA 2007

**NPC**

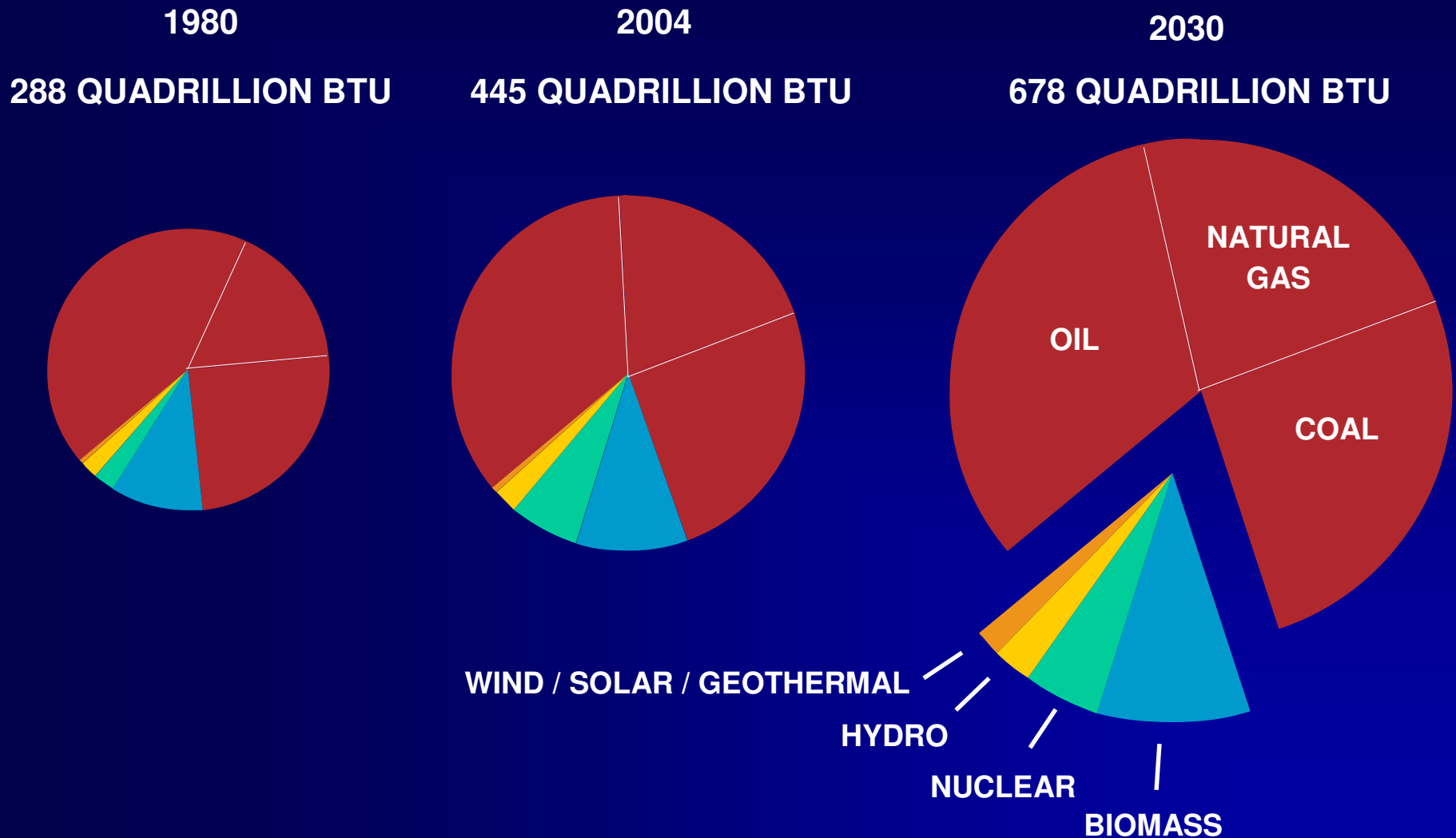
*Global Oil and Gas Study*

# Range of Projections Point to Growing Demand

## TOTAL ENERGY



# Coal, Oil, and Natural Gas Will Remain Indispensable



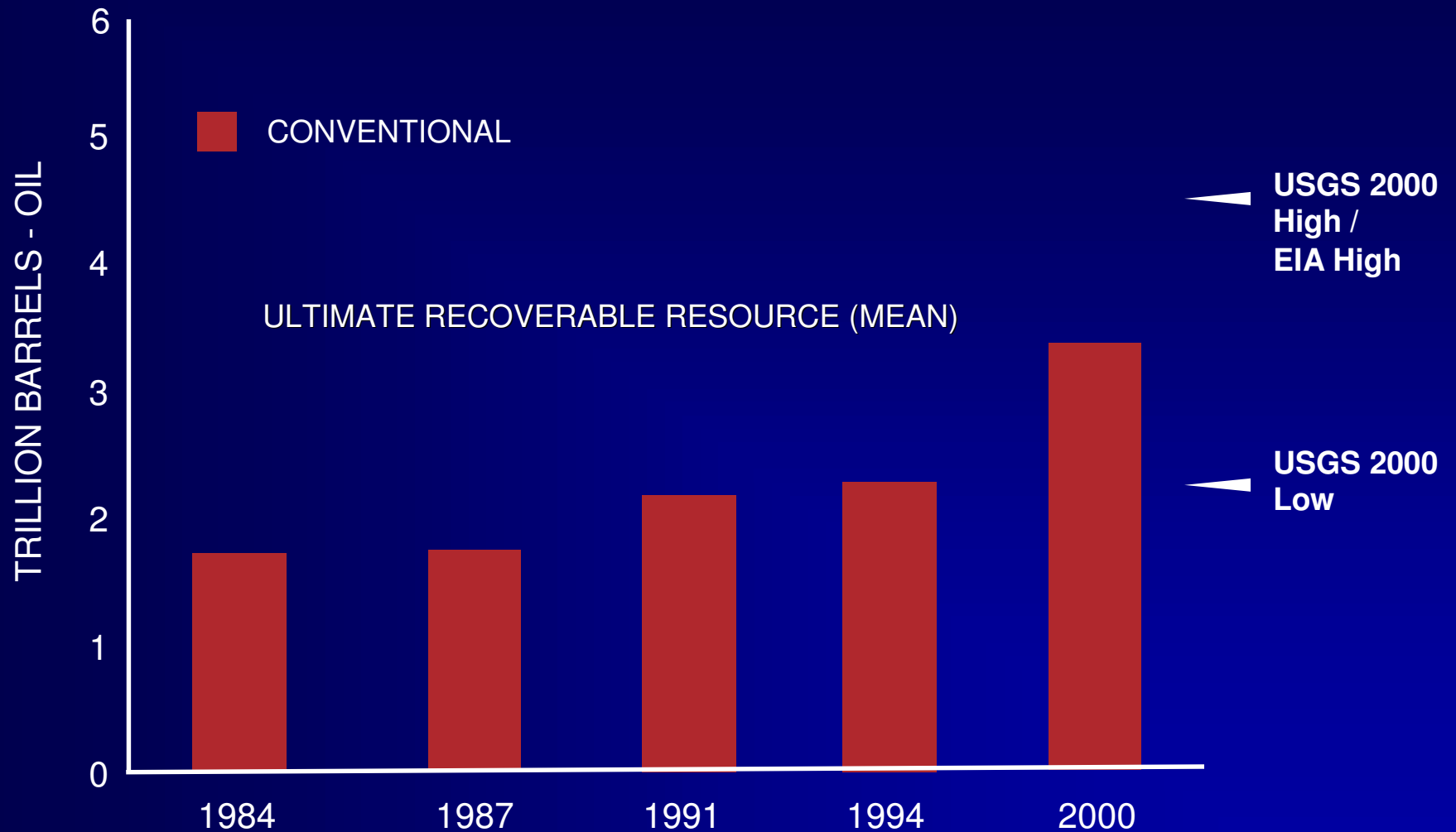
Source: IEA REFERENCE CASE

## *The Hard Truth: Supply*

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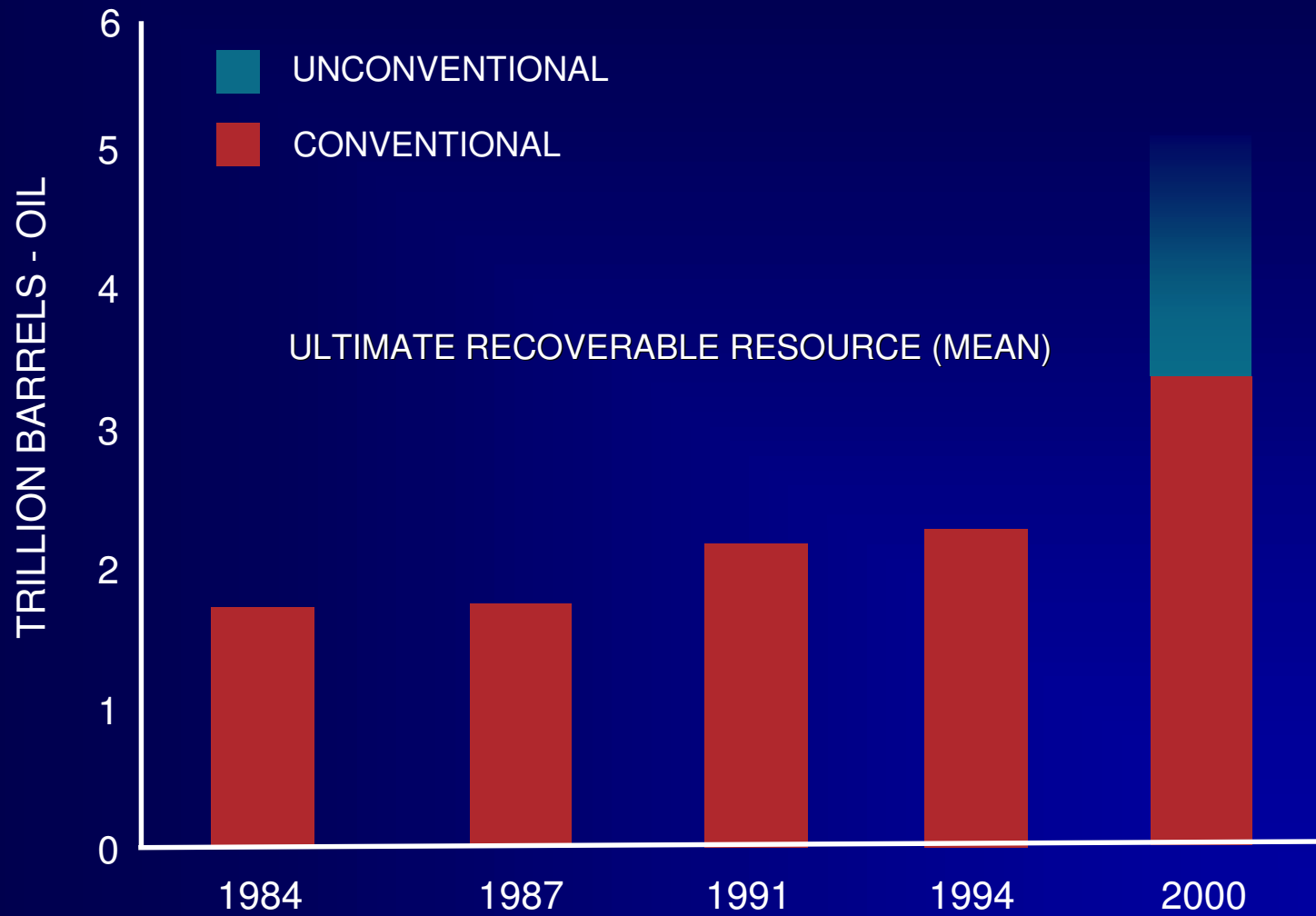
The world is not running out of energy resources, but there are accumulating risks to continuing expansion of oil and natural gas production from the conventional sources relied upon historically. These risks create significant challenges to meeting projected total energy demand.

# Wide Range of Projections



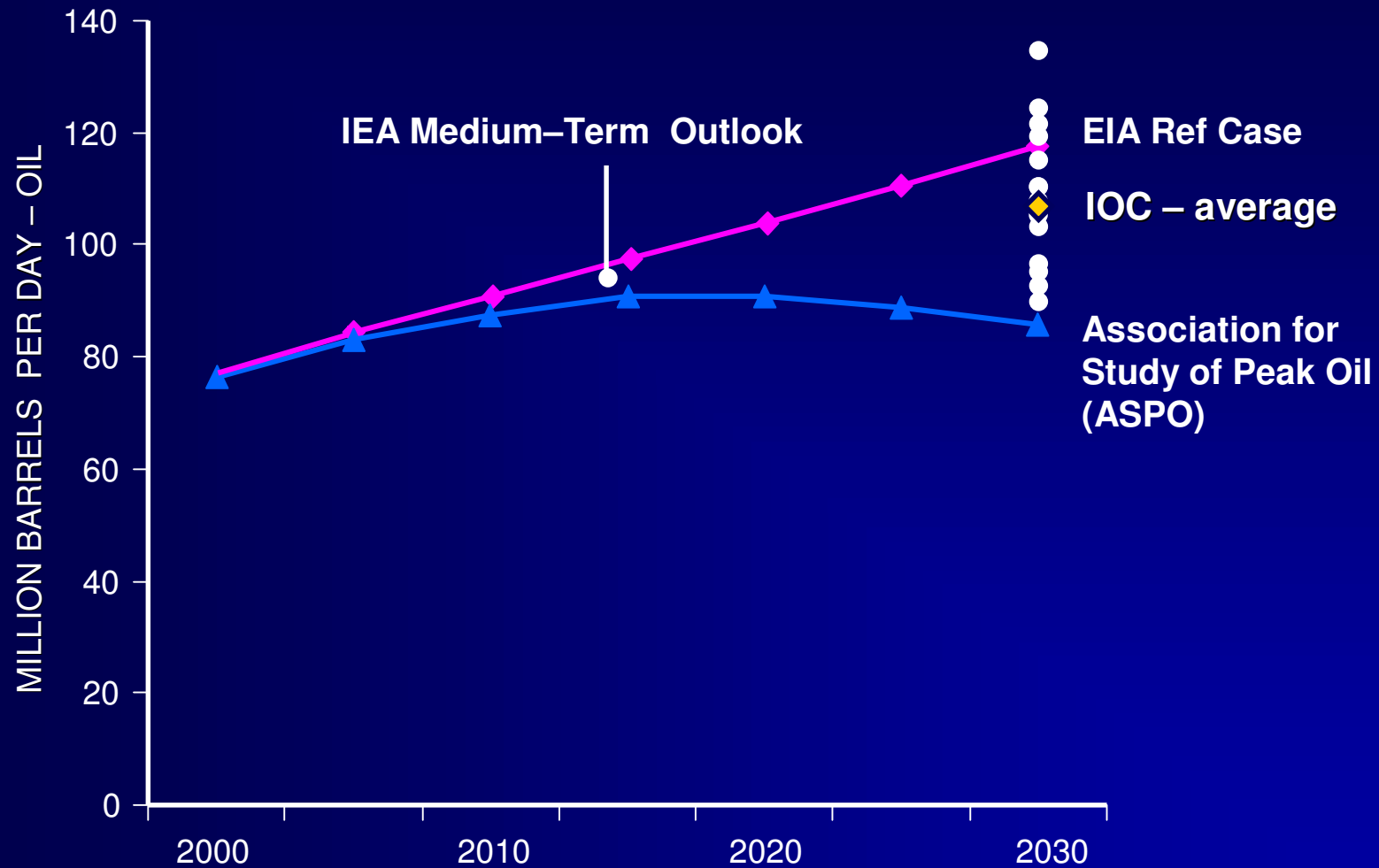
Source: USGS

# Large Oil Resource Base



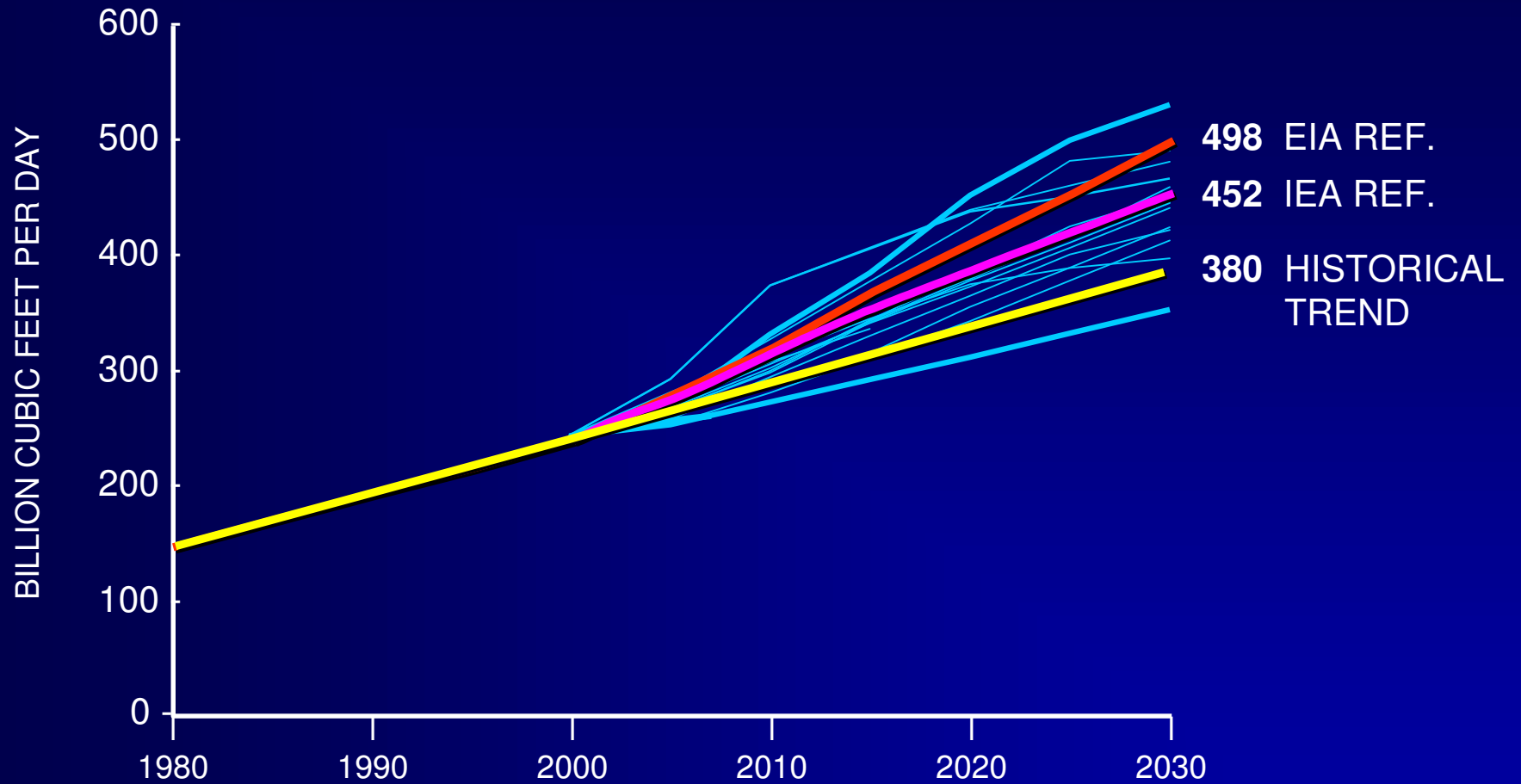
Source: USGS

# Risks Reflected in Range of Production Projections



\* Source: NPC Data Warehouse.

# Range of Global Supply Projections – Gas



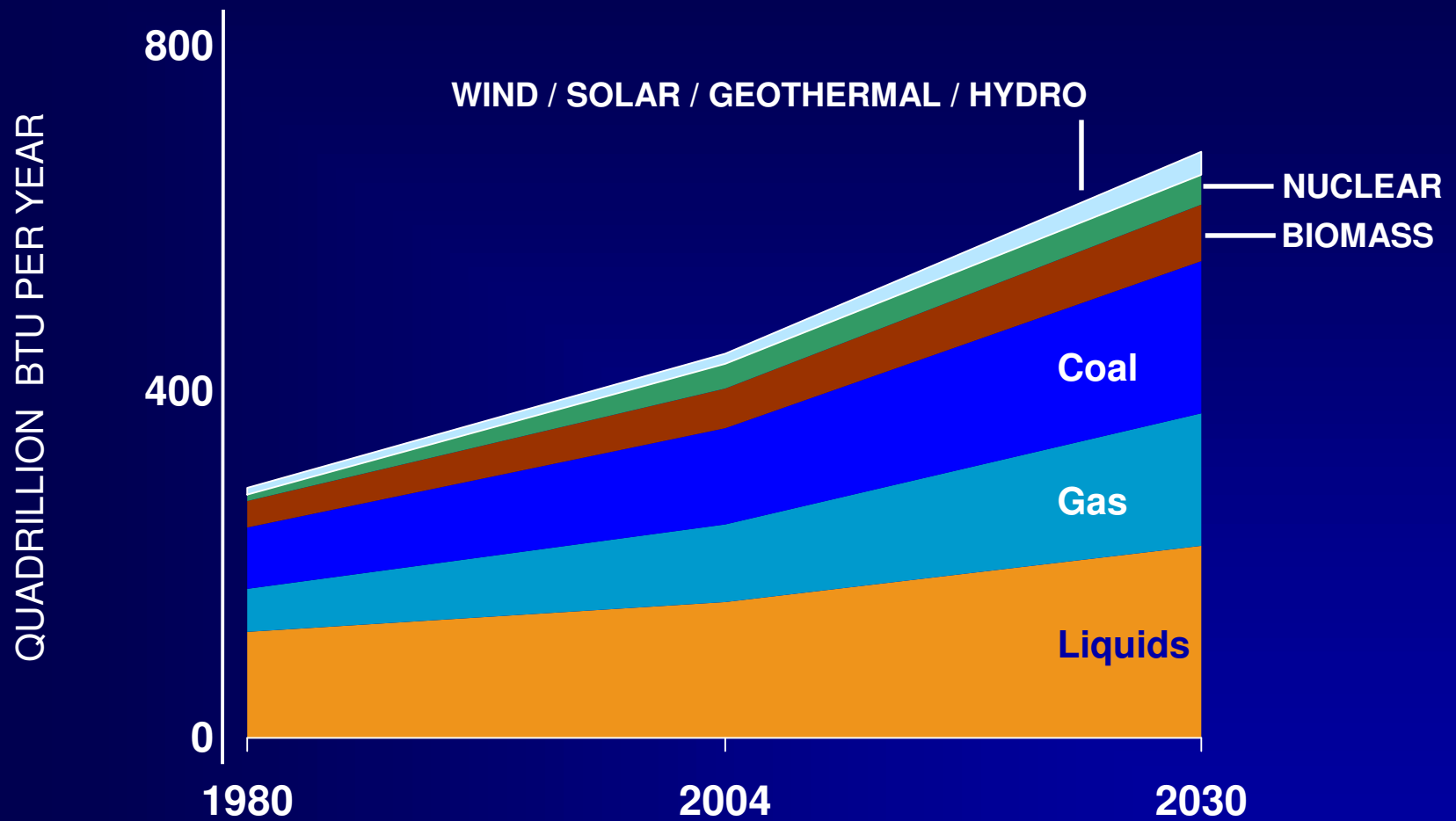
Source: NPC Survey for the Oil & Gas Study.

## *The Hard Truth: Energy Sources*

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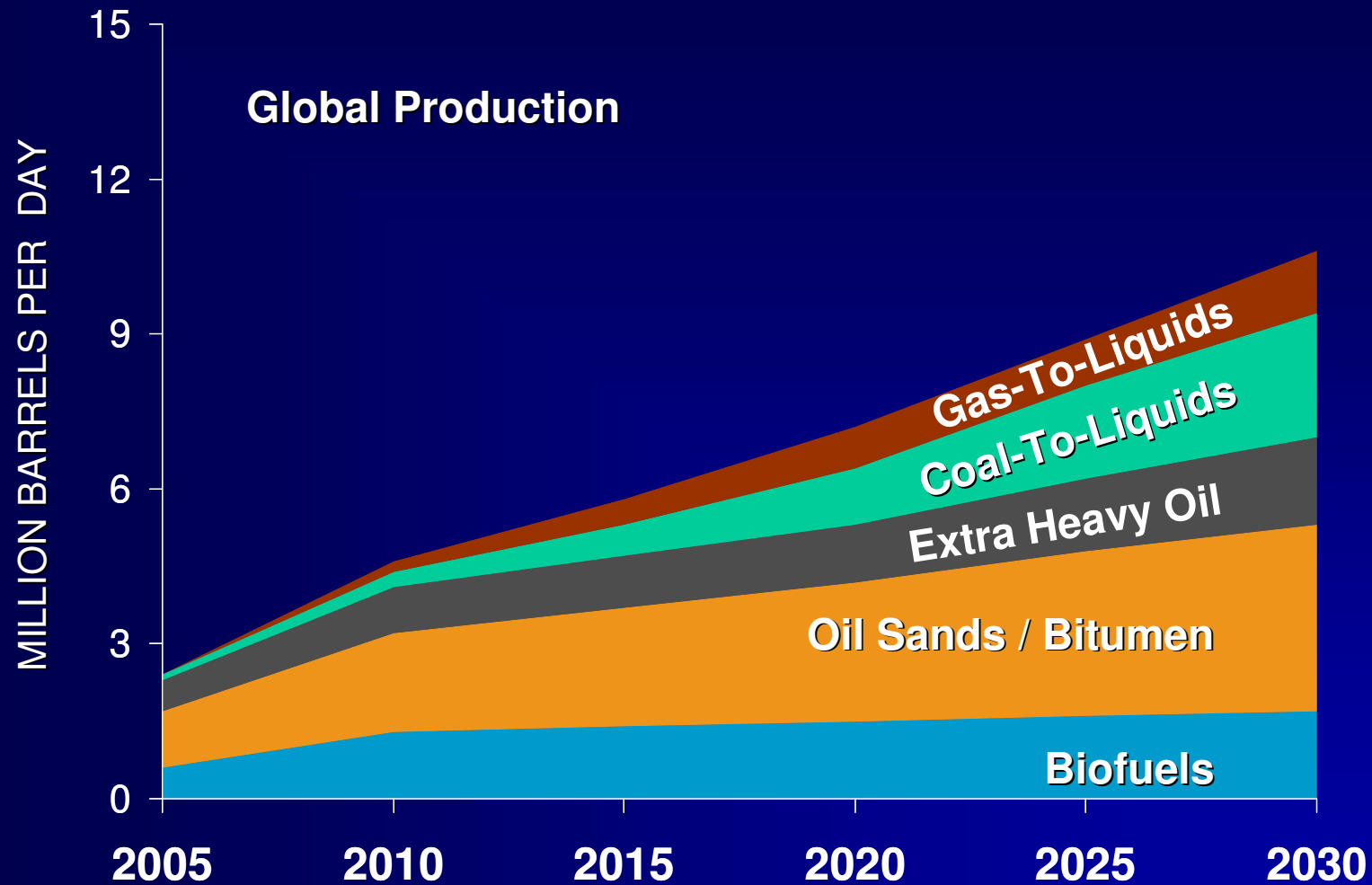
To mitigate these risks, expansion of all economic energy sources will be required, including coal, nuclear, biomass, other renewables, and unconventional oil and natural gas. Each of these sources faces significant challenges including safety, environmental, political, or economic hurdles, and imposes infrastructure requirements for development and delivery.

# All Sources of Energy Will Be Needed



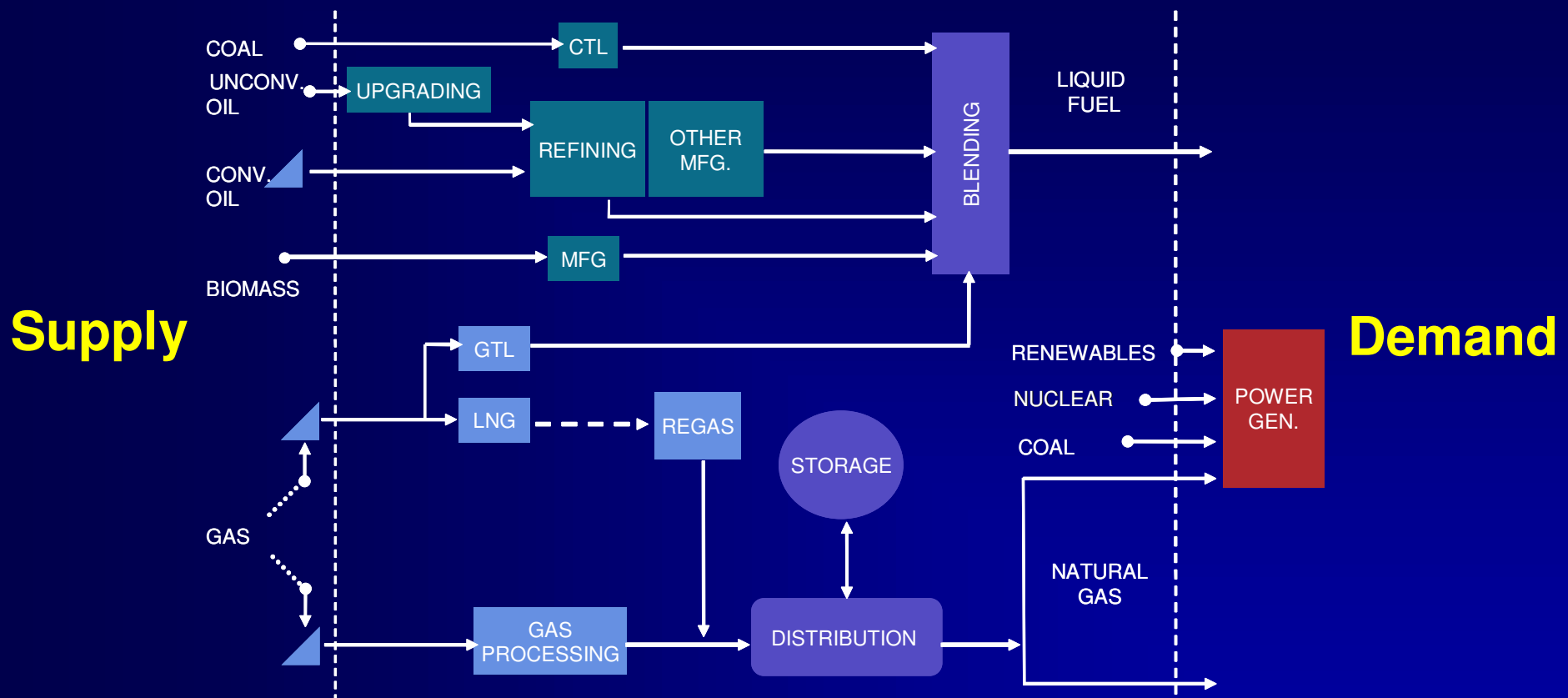
Source: IEA REFERENCE CASE

# Contribution of Unconventional Liquids



Source: Data From EIA 2007 Reference.

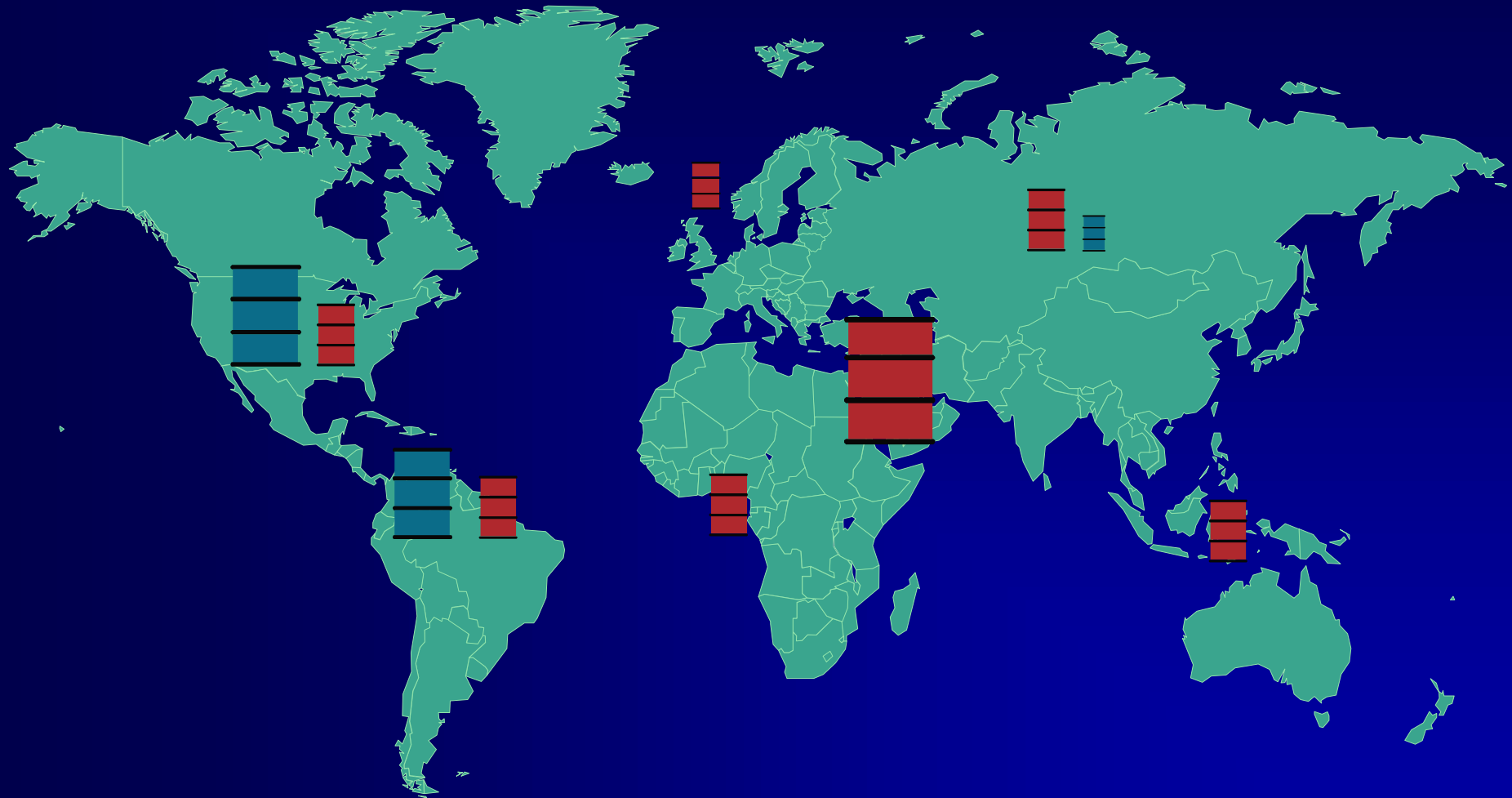
# Massive Infrastructure Investments Required



## *The Hard Truth: Energy Security*

"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

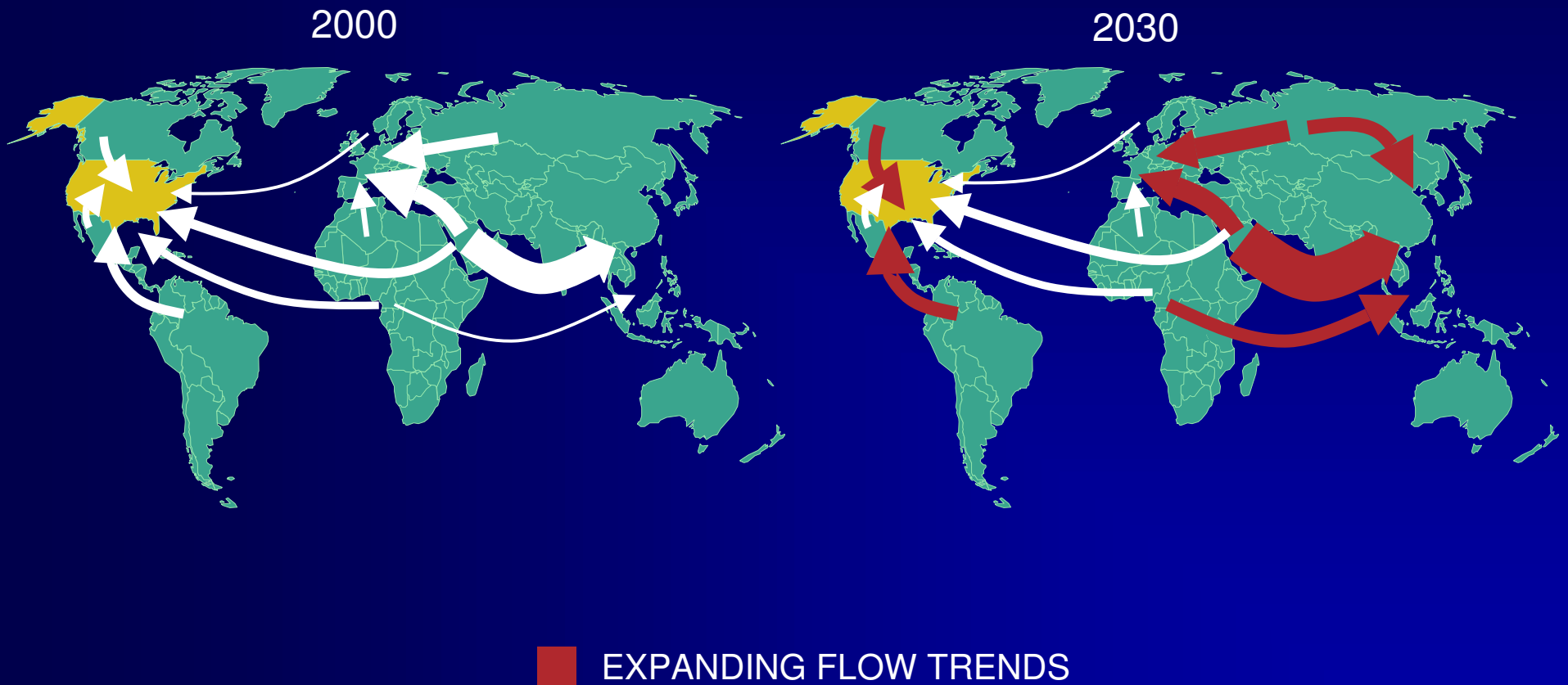
UNCONVENTIONAL

CONVENTIONAL

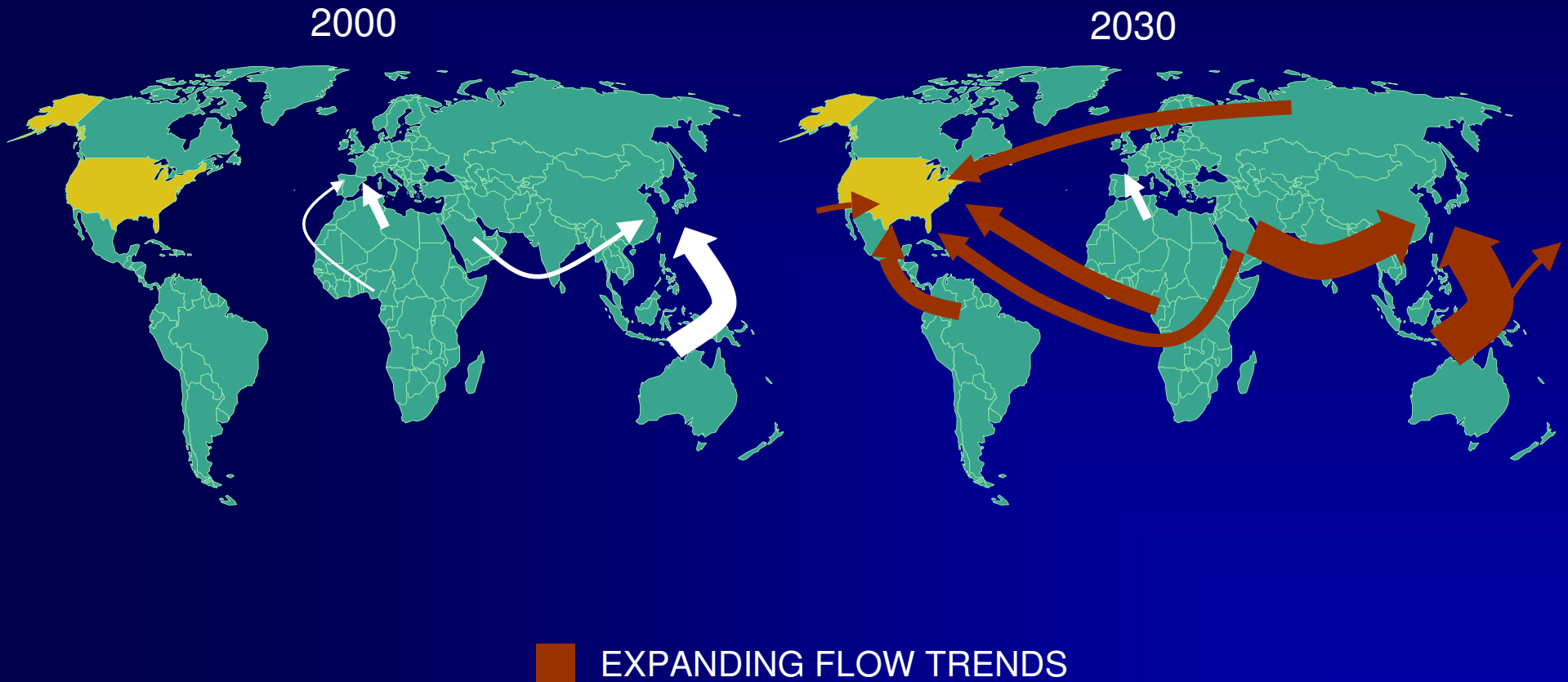
*Global Oil and Gas Study*

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# Global Oil Trade



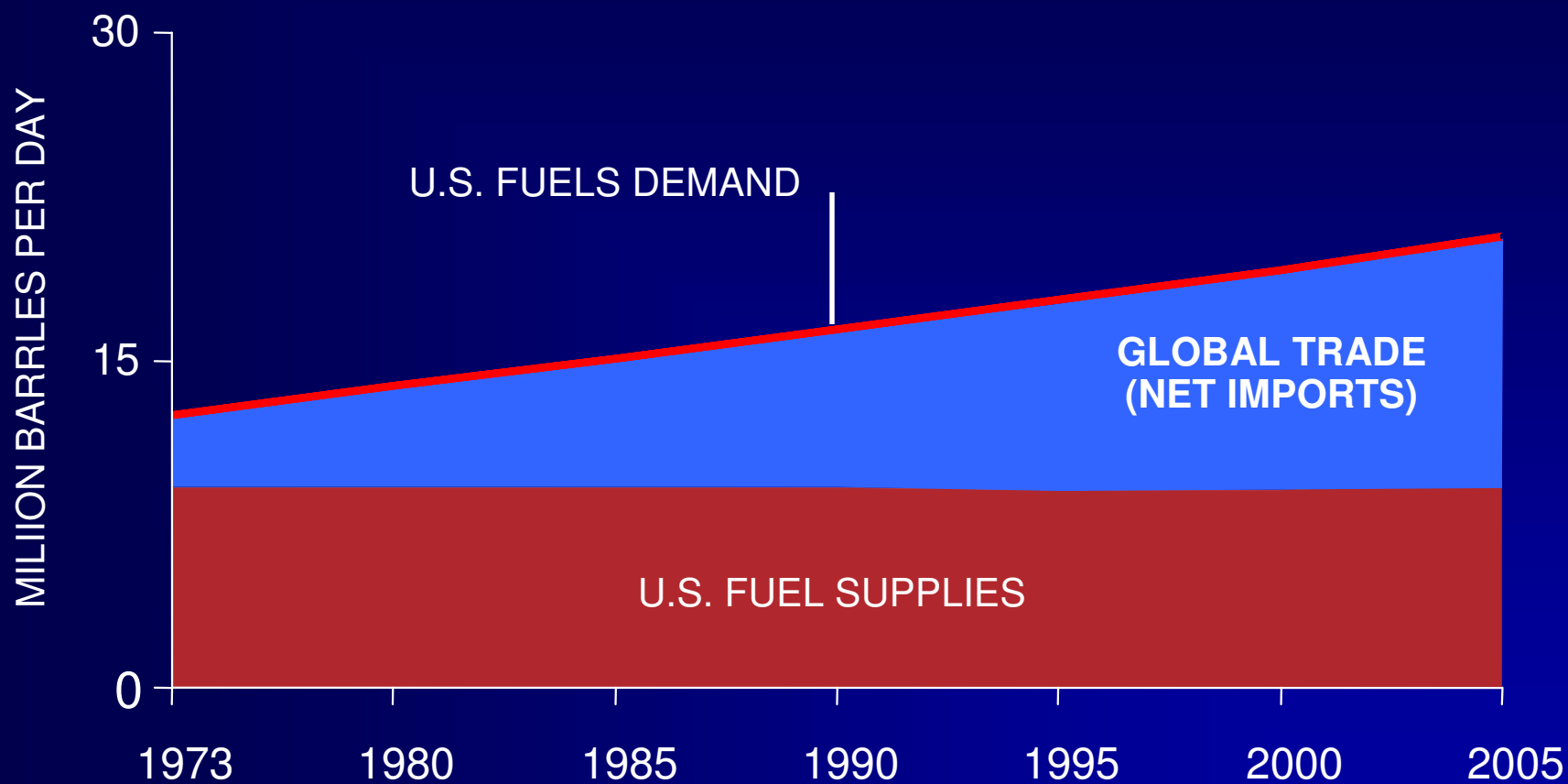
# Global LNG Trade



# Supply Vulnerability Zones



# U.S. Historical Supply and Demand Trends



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

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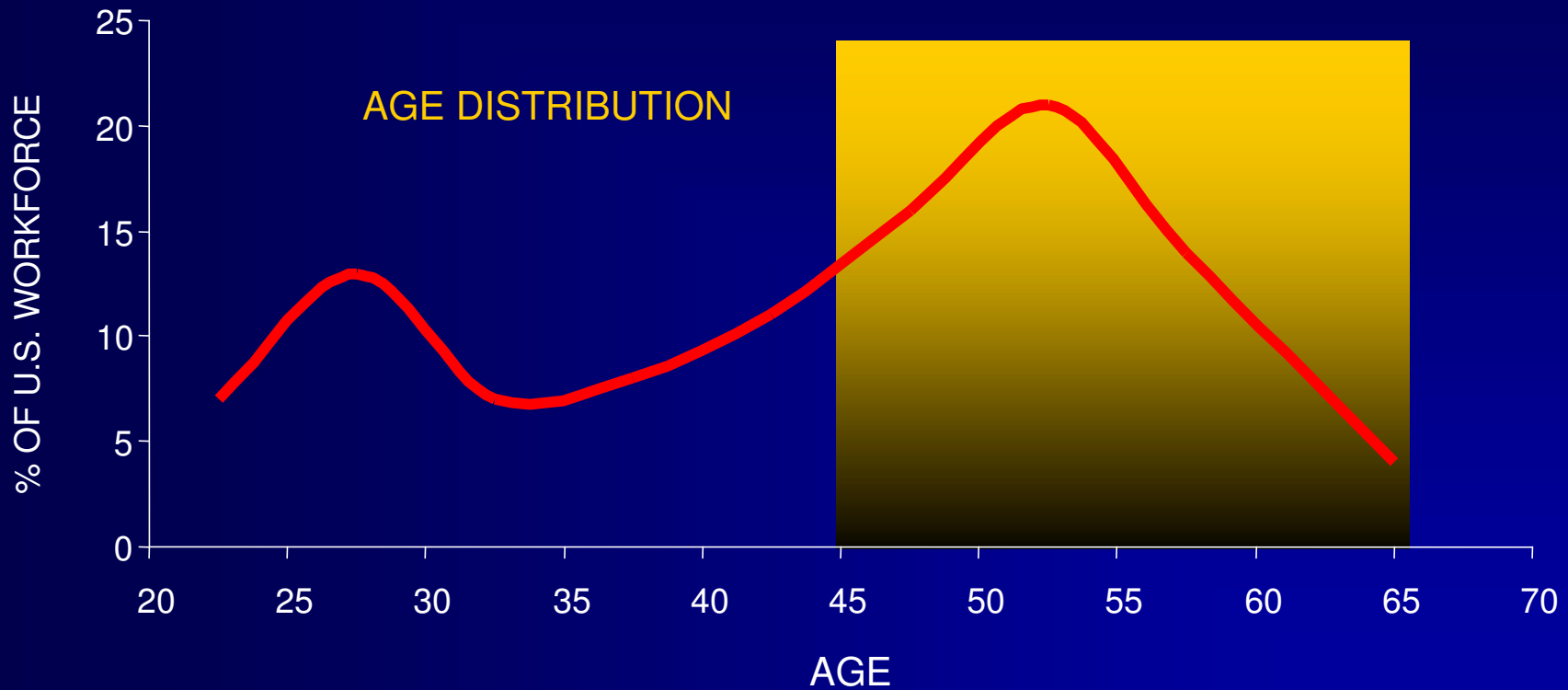
## *The Hard Truth: Workforce*

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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.

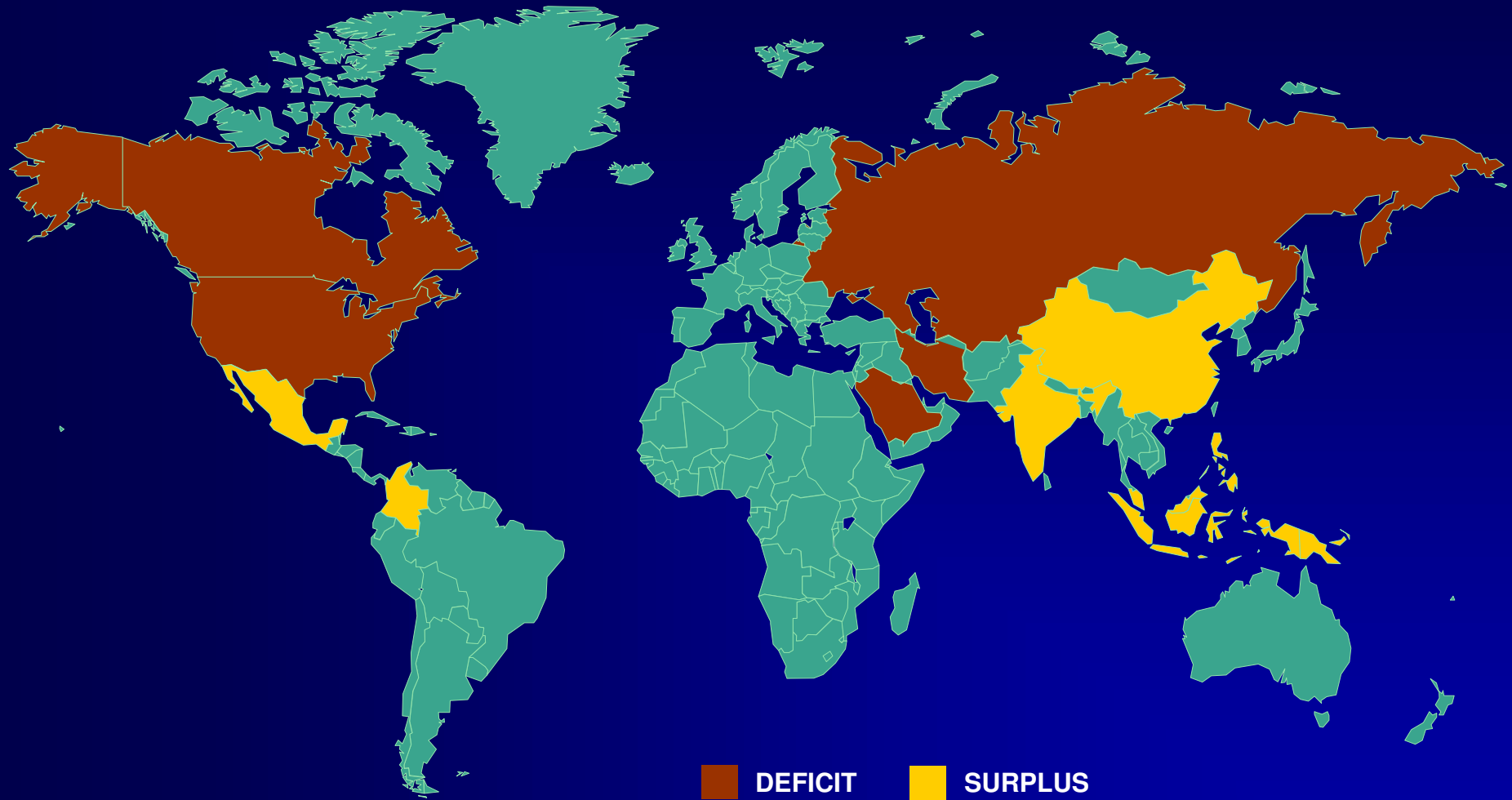
# U.S. Human Resources Challenge

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).

# *The Hard Truth: Carbon Emissions*

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Policies aimed at curbing carbon dioxide emissions will alter the energy mix, increase energy-related costs, and require reductions in demand growth.

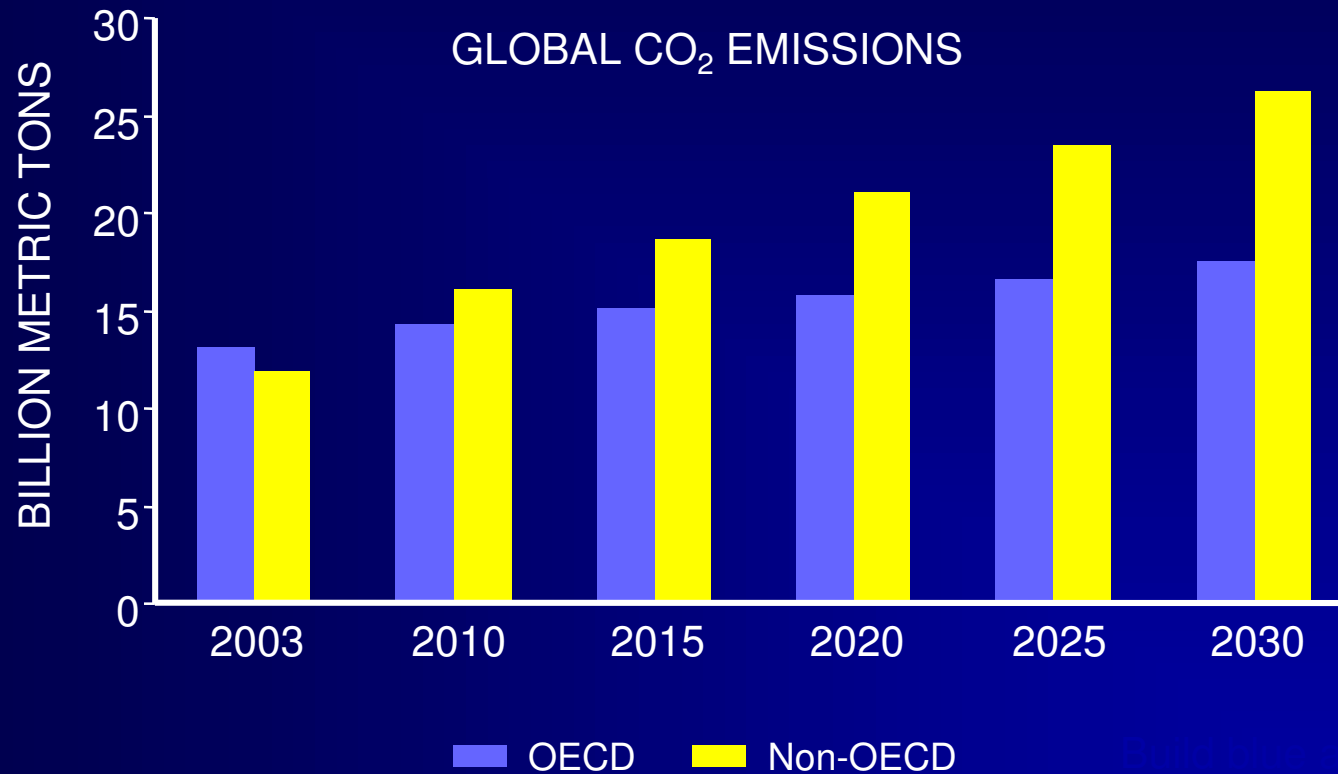
# *CO<sub>2</sub> Emission Limits Will Alter Energy Strategies*

Growing concern that climate is warming and CO<sub>2</sub> concentrations in the atmosphere play a role.

The challenge of significantly reducing CO<sub>2</sub> 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



Source: EIA 2006

# *Carbon Mitigation*

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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*

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- 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*

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Moderate Demand By Increasing Energy Efficiency

## *Moderate Demand Growth*

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

## *Moderate Demand Growth*

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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*

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

# *The Five Core U.S. Strategies*

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Expand And Diversify U.S. Energy Supply

# *Expand and Diversify Supply*

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

Increase access for new energy development.

# *Expand and Diversify Supply*

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## 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

# *The Five Core U.S. Strategies*

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Strengthen Global And U.S. Energy Security

# *Promote Global and U.S. Energy Security*

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Integrate energy policy into trade, economic, environmental, security, and foreign policies.

## *Promote Global and U.S. Energy Security*

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Continue to develop the international energy marketplace by expanding the energy dialog with major producing and consuming nations.

## *Promote Global and U.S. Energy Security*

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Promote an effective global energy marketplace by sustaining and intensifying efforts to encourage global adoption of transparent, market-based approaches.

## *Promote Global and U.S. Energy Security*

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Assist and encourage global adoption of energy efficiency technologies through technology transfer programs.

# *The Five Core U.S. Strategies*

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Reinforce Capabilities To Meet New Challenges

# *Reinforce Capabilities to Meet New Challenges*

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Rebuild U.S. science and engineering capabilities.

Create research and development opportunities.

# *Reinforce Capabilities to Meet New Challenges*

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Improve the quality of energy data and information.

Develop a comprehensive forecast of U.S. infrastructure requirements.

# *The Five Core U.S. Strategies*

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Address Carbon Constraints

# *Actions to Address Carbon Constraints*

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Develop legal and regulatory framework to enable carbon capture and sequestration.

# *Actions to Address Carbon Constraints*

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As options are considered to reduce CO<sub>2</sub> emissions:

- Provide effective global framework for carbon management
- Establish transparent, predictable, economy-wide cost for CO<sub>2</sub> emissions

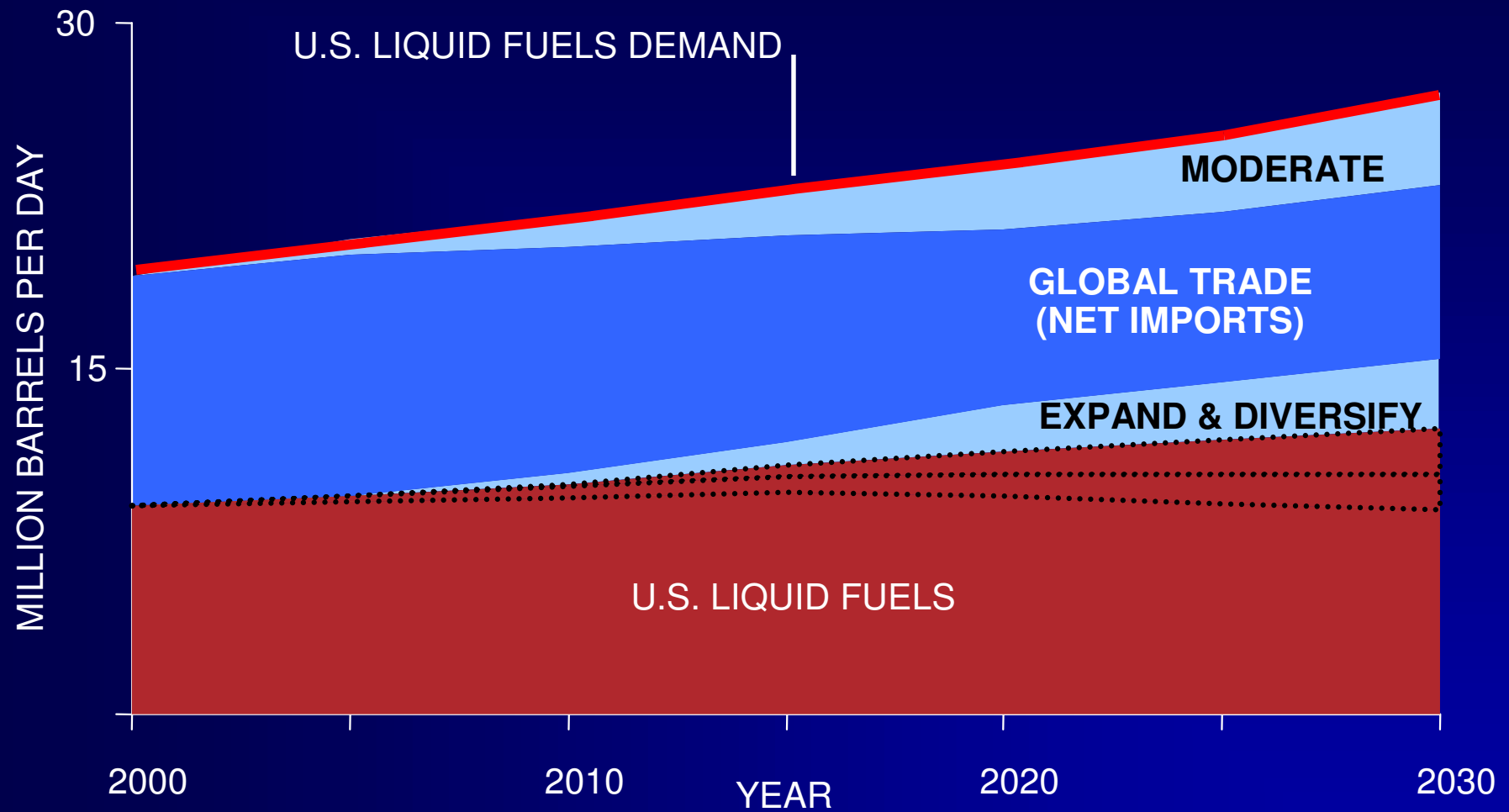
# *Summary*

## *There Is No Single, Easy Solution*

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- 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

**NPC**

*Global Oil and Gas Study*

*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](mailto:comments@npc.org)***