# Facing The Hard Truths About Energy

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

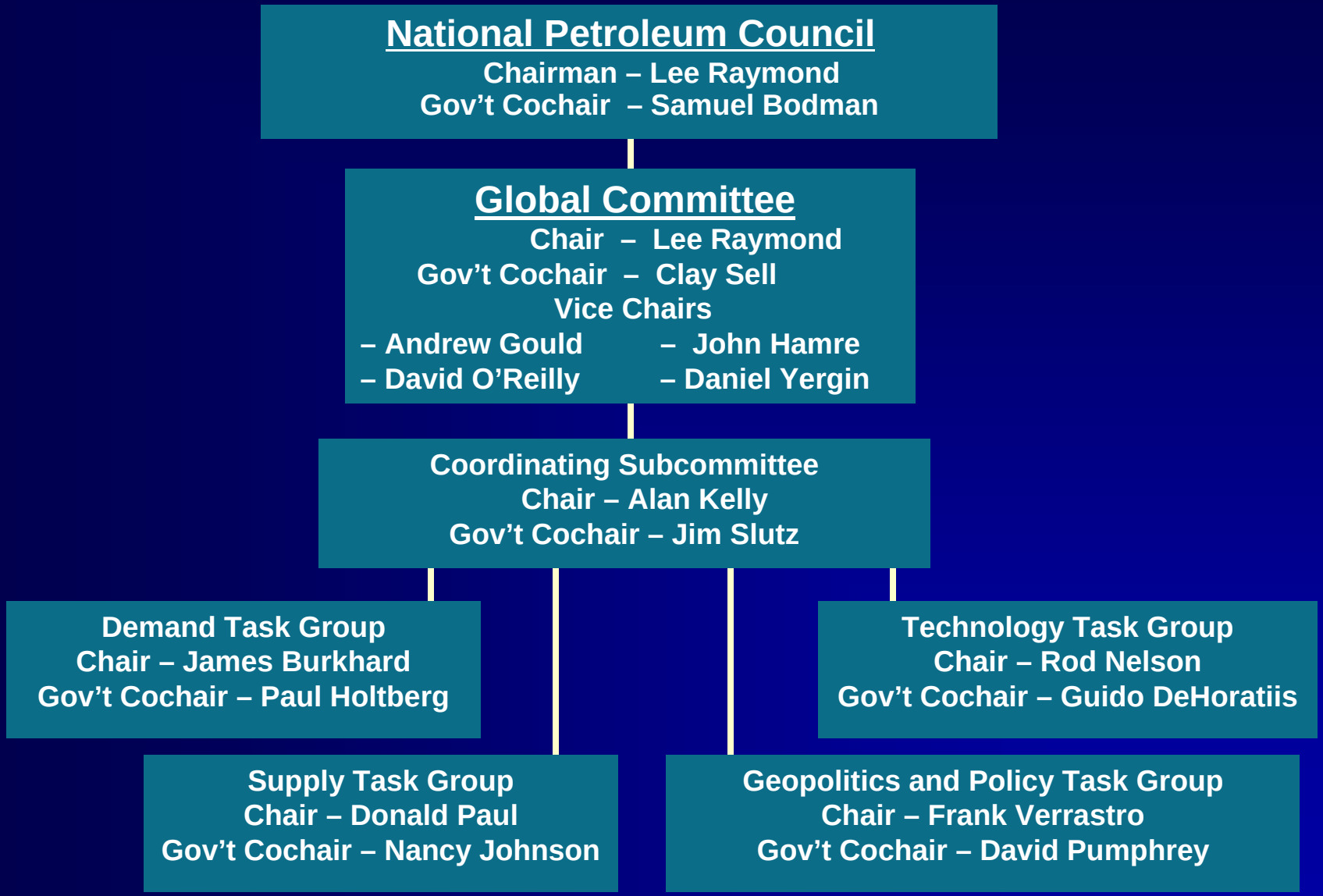
**CSIS Presentation**

**August 1, 2007**

# *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 ?

# Study Leadership



# Dimensions of the Study

# 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**

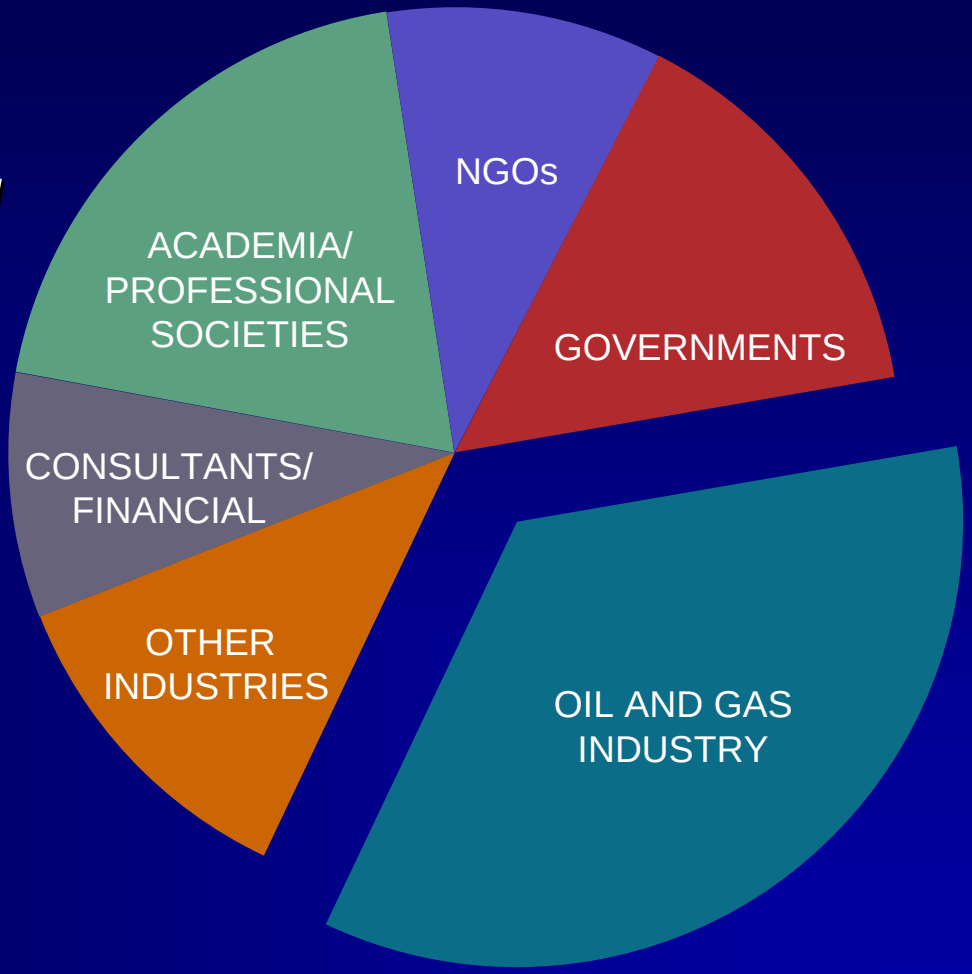
- 350 participants with backgrounds in all aspects of energy including efficiency, economics, geopolitics, environment

**Technology Assessment**

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

# How This Study is Different

*65% participants from outside of oil and gas industry*




***350 + participants, plus input from 1000 + others***

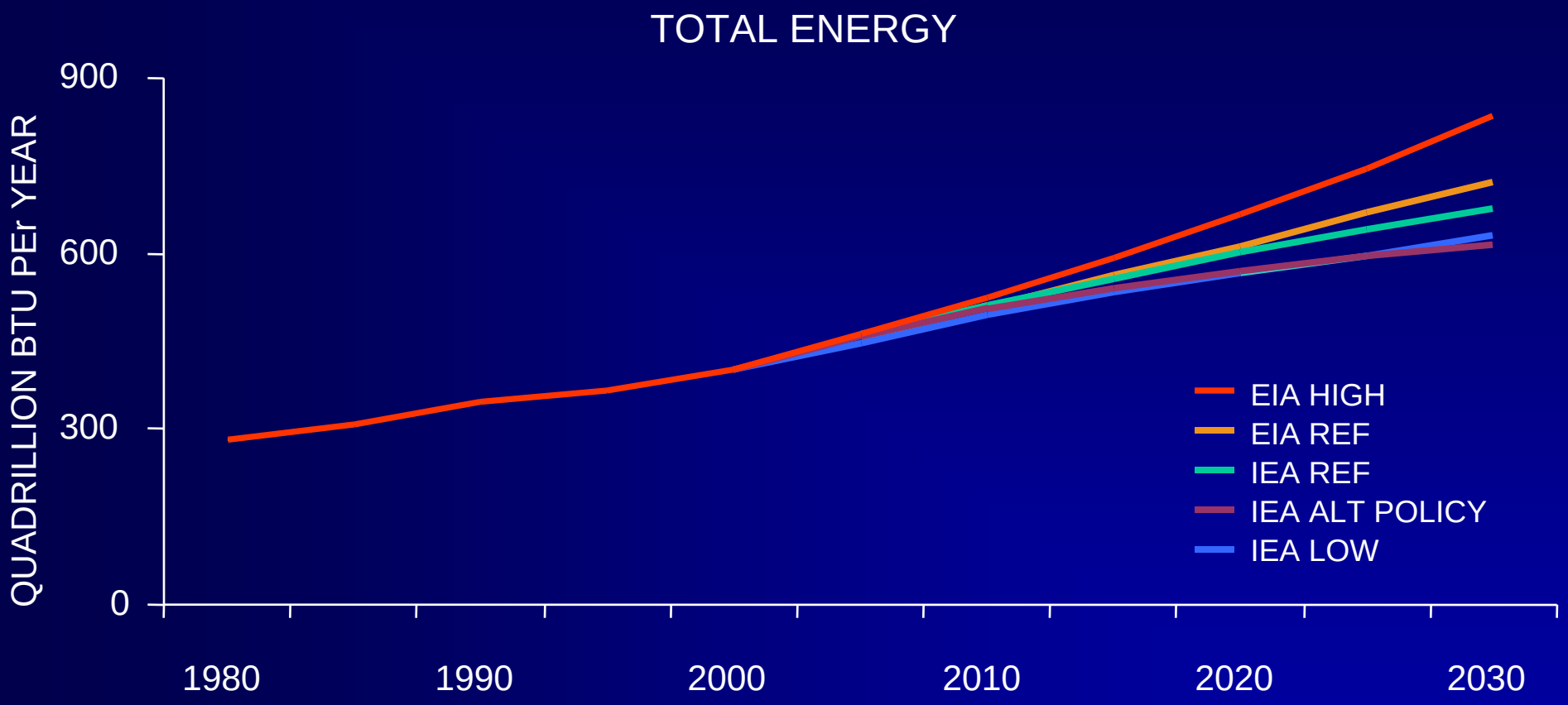
# *What We Learned: The Hard Truths*

# *The Hard Truth: Demand*

Most forecasts project global energy demand growth to increase by 50-60%, mainly as a result of population growth and improved living standards;

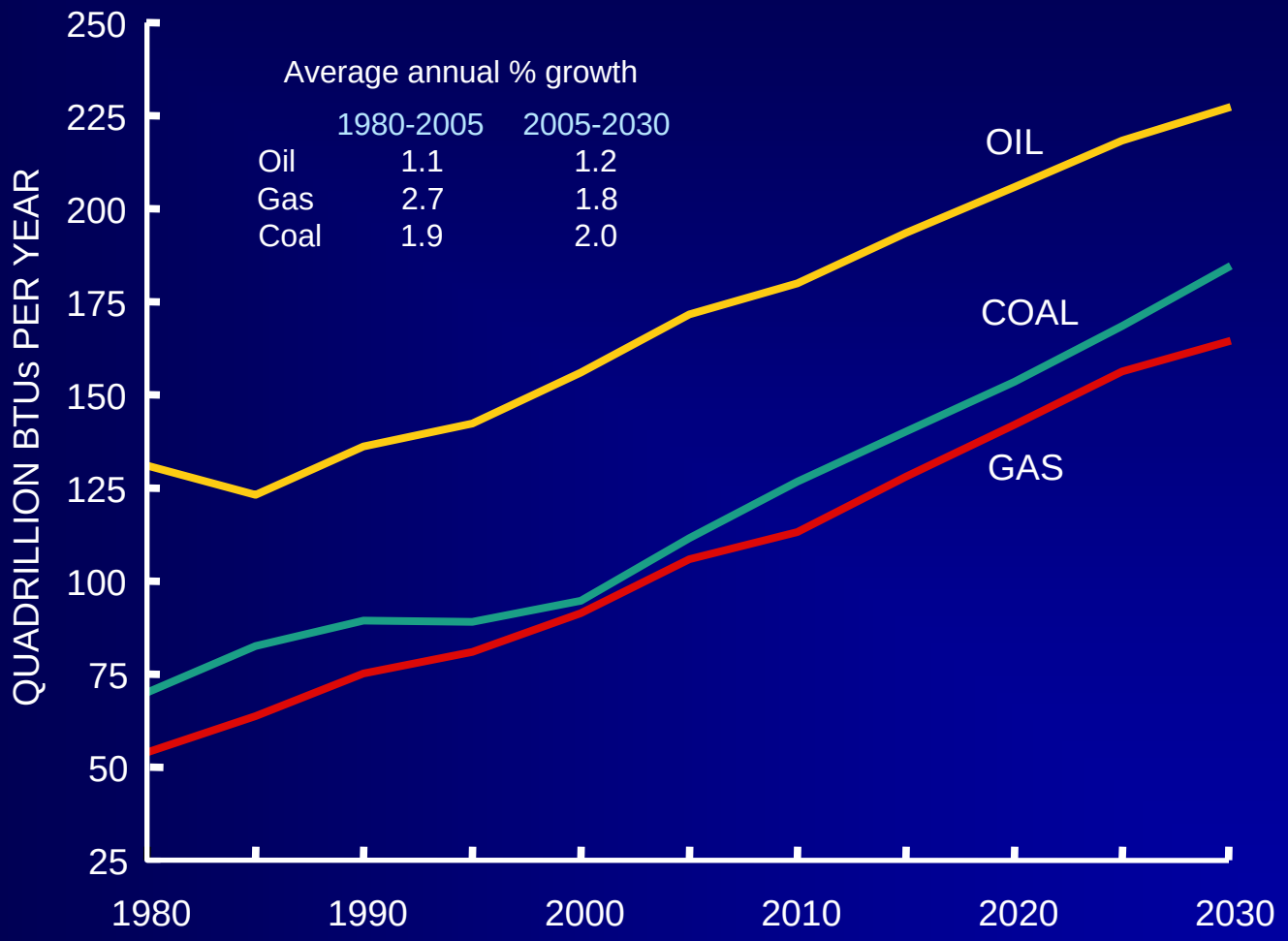
Coal, oil, and natural gas will remain indispensable to meeting total projected energy demand.

# Range of Projections Point to Growing Demand



# Global Demand Outlooks – Fossil Fuels

## Average of projections for each fuel

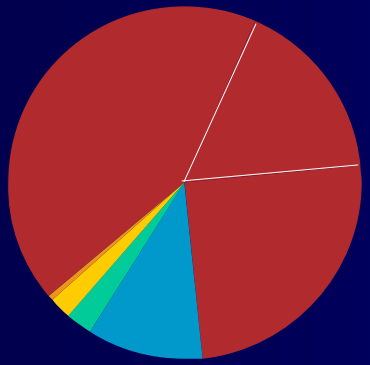



Source: NPC Global Oil and Gas study survey.

# Coal, Oil, and Natural Gas Will Remain Indispensable

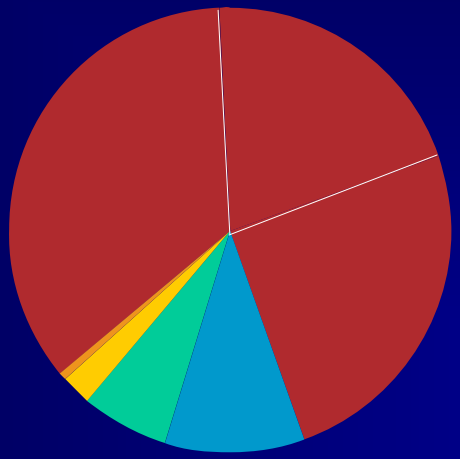
**1980**

**288 QUADRILLION BTU**



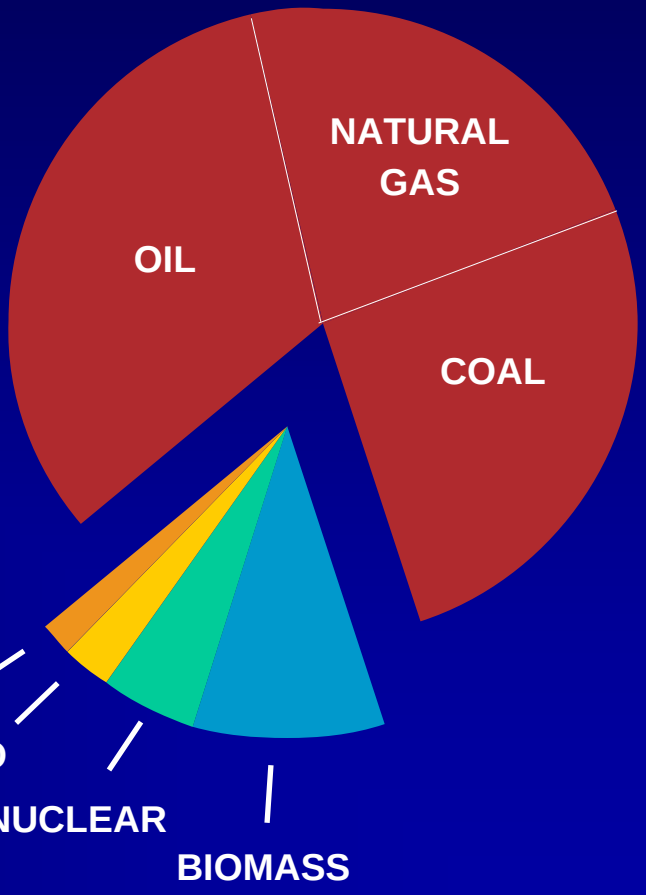
**2004**

**445 QUADRILLION BTU**



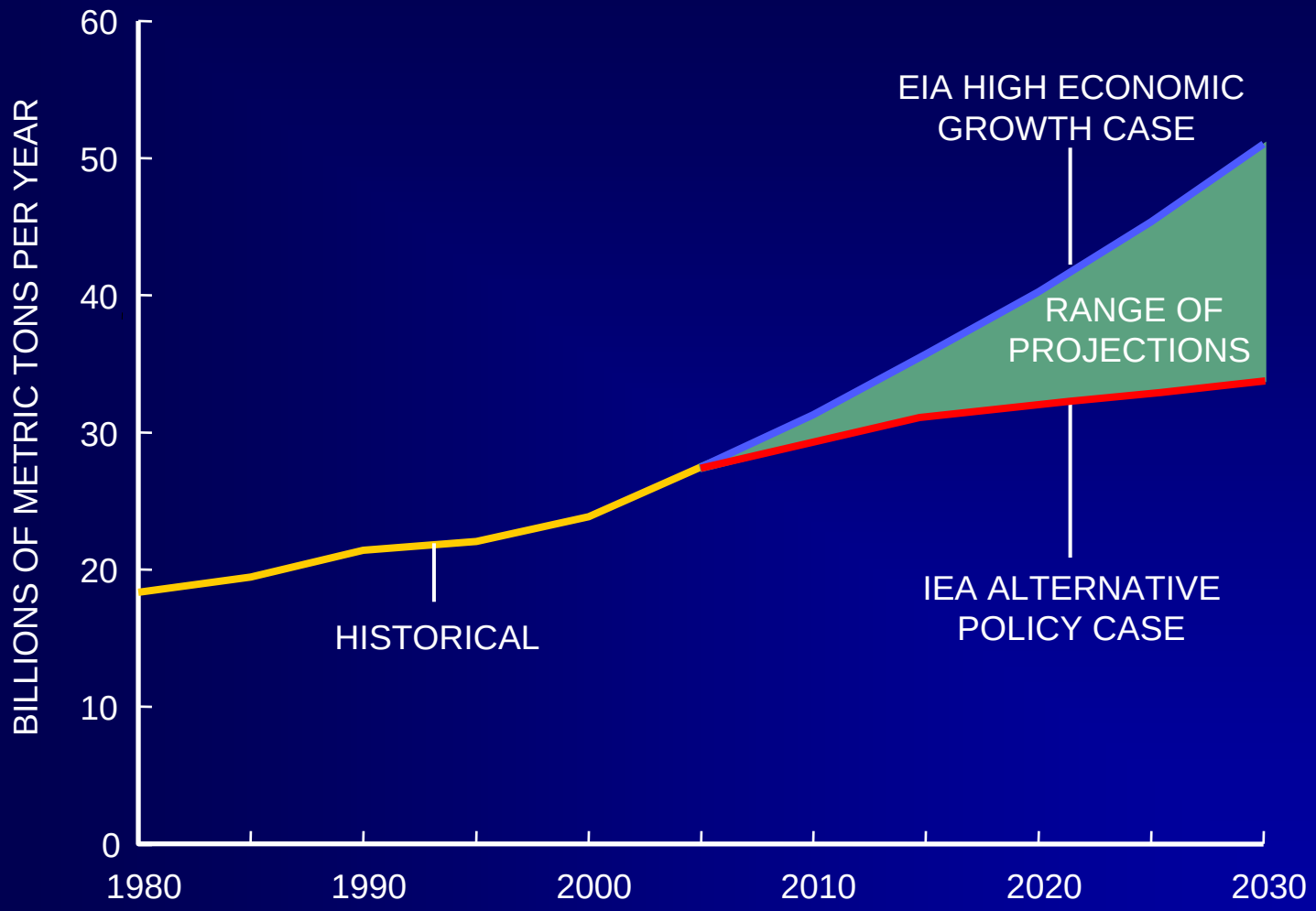
**2030**

**678 QUADRILLION BTU**




Source: IEA REFERENCE CASE

# Global $CO_2$ Emissions Projections




Source: NPC Global Oil and Gas study survey.

# *Demand Task Group Observations*

Survey of projections indicates:

- Income and population are prime drivers of demand
- US energy efficiency improvement is equal to or less than in the past in most projections
- $CO_2$ emissions closely related to anticipated energy use
- Fossil fuels to remain the largest energy source
- Asia's share of global demand rises ~10% by 2030

# *Demand Task Group Observations (continued)*

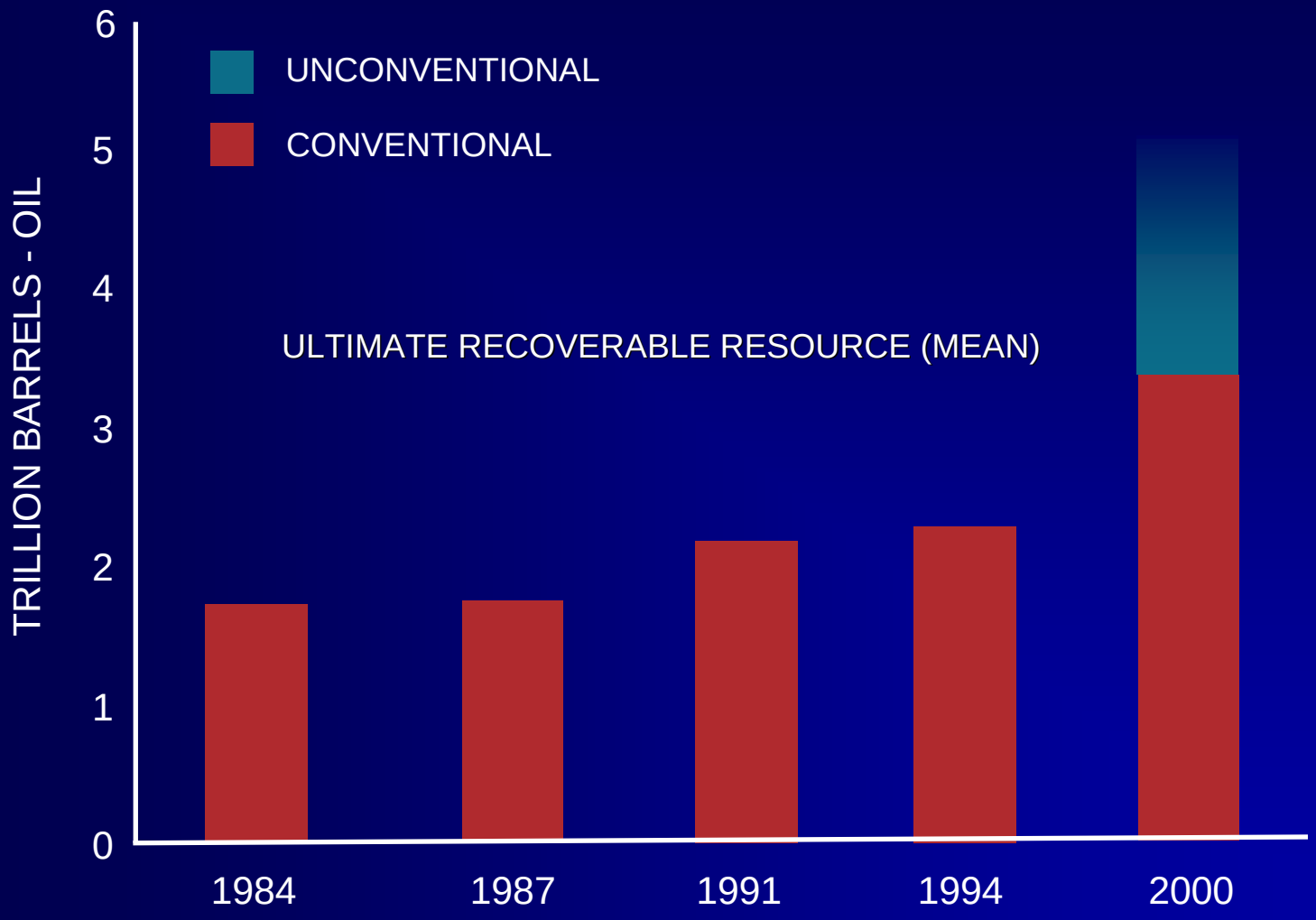
Survey of projections also indicates:

- Transportation is largest component of oil demand growth in US and world
- Nuclear energy has smaller share of energy mix in all but one projection
- Energy intensities of US and global economies decline
- Global per capita energy consumption increases
  - US per capita energy consumption projected to remain highest in the world

# The Hard Truth: Supply

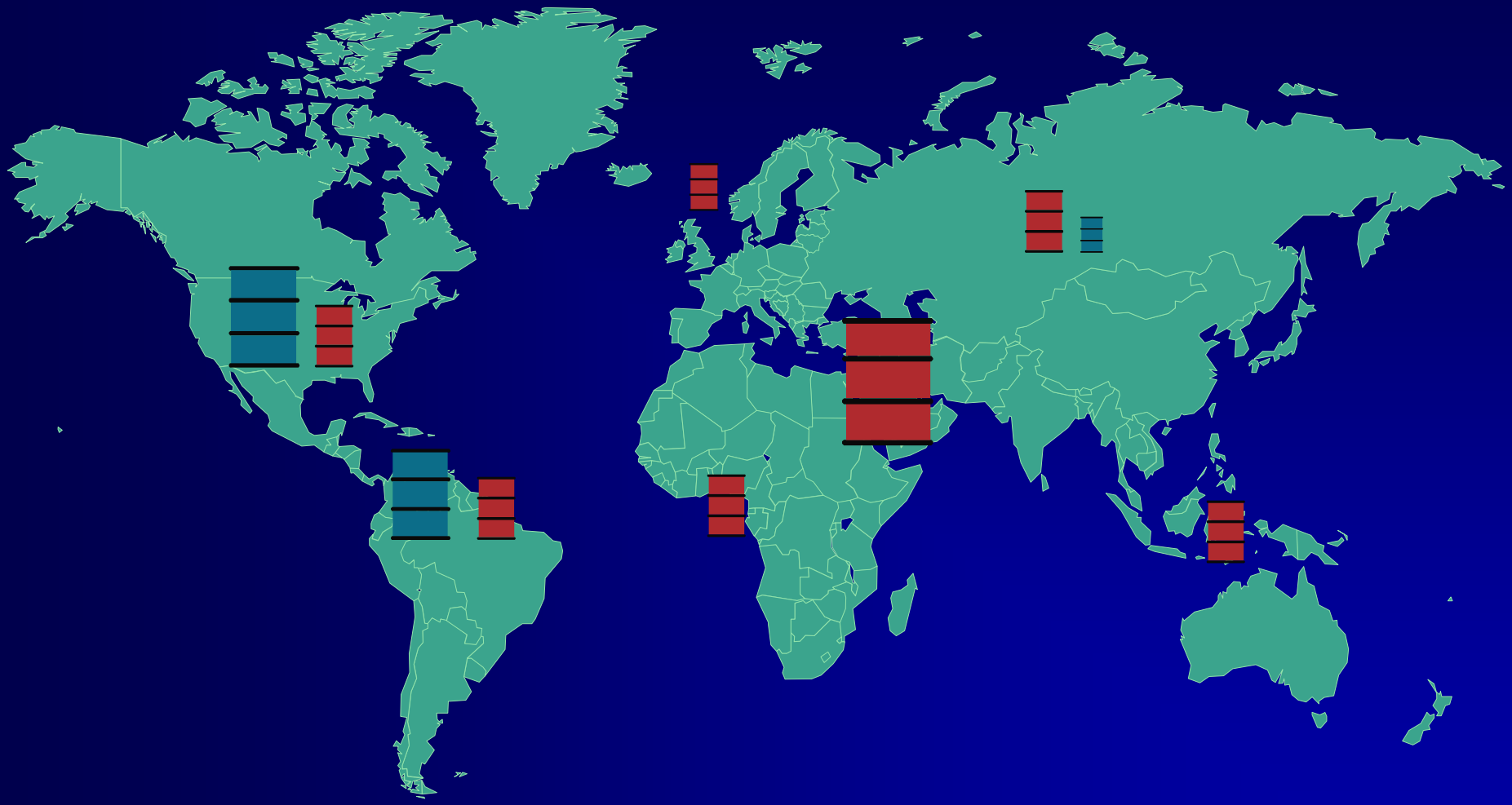
The world is not running out of energy resources, but there are accumulating risks to continuing expansion of oil and natural gas production from the conventional sources relied upon historically. These risks create significant challenges to meeting projected total energy demand.

# Large Oil Resource Base




Source: USGS

# Oil Resource Concentration



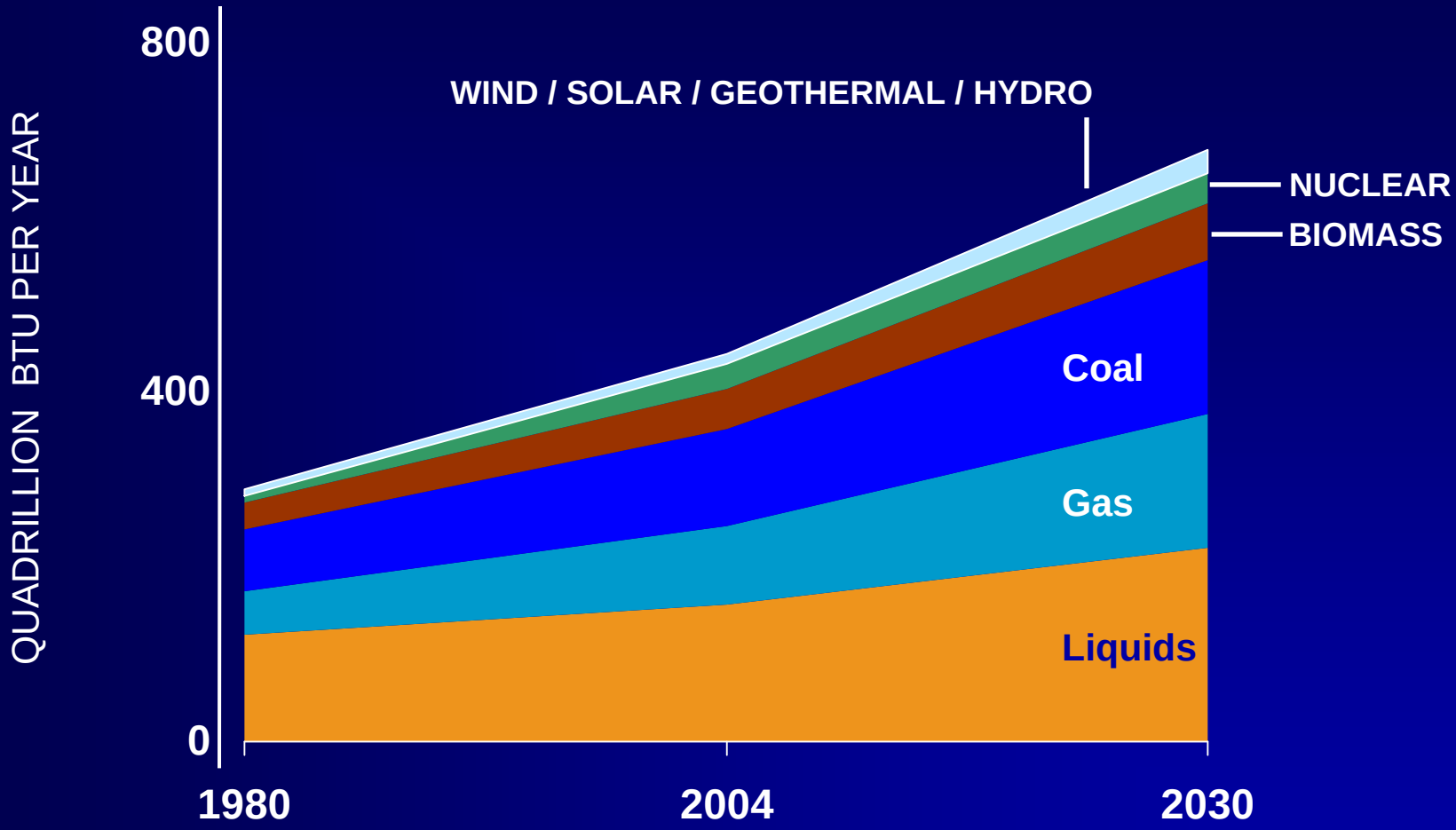
UNCONVENTIONAL

CONVENTIONAL

**ILLUSTRATIVE PROJECTION**

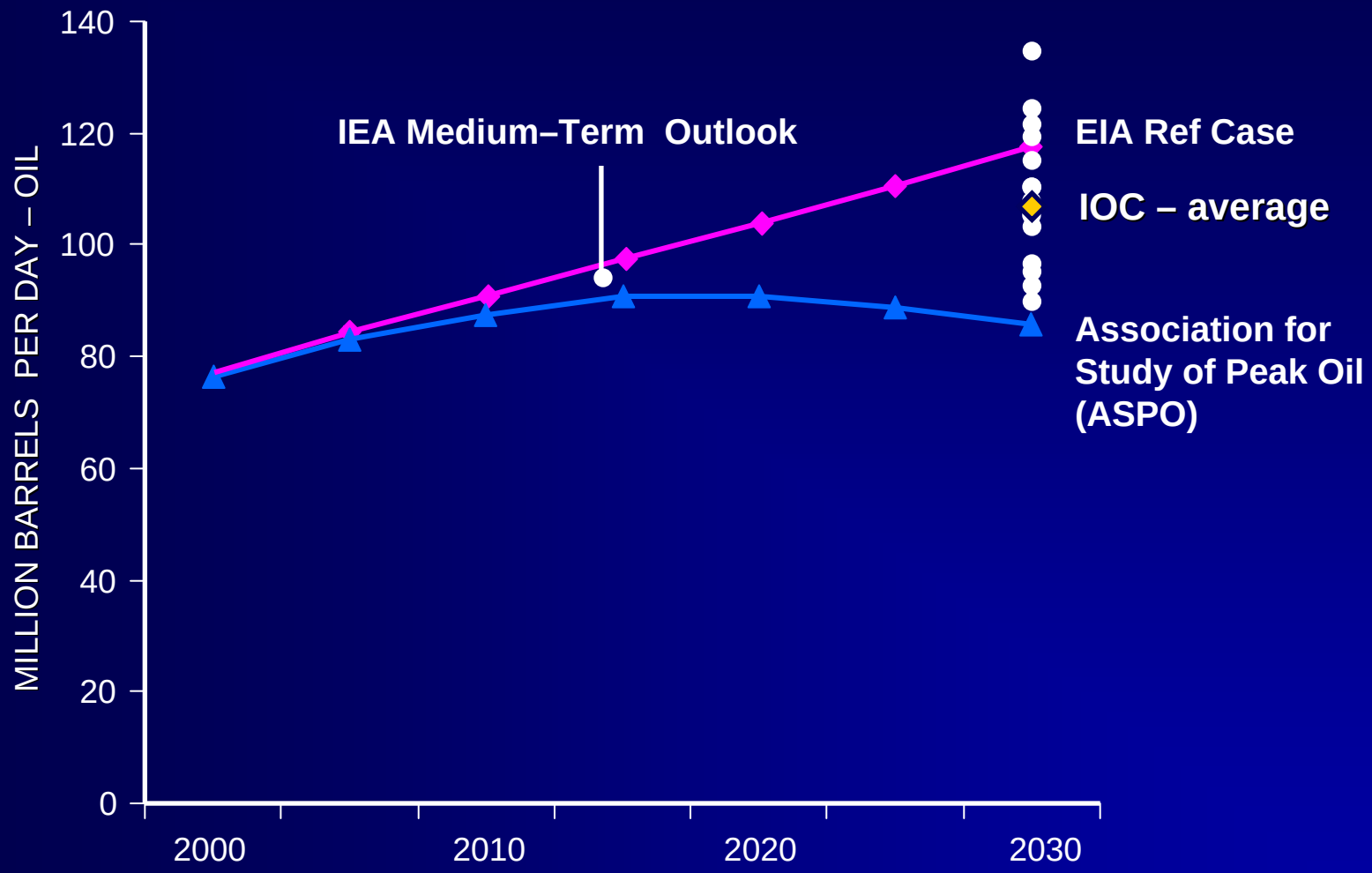
**Source USGS**

# All Sources of Energy Will Be Needed




Source: IEA REFERENCE CASE

# Risks Reflected in Range of Production Projections

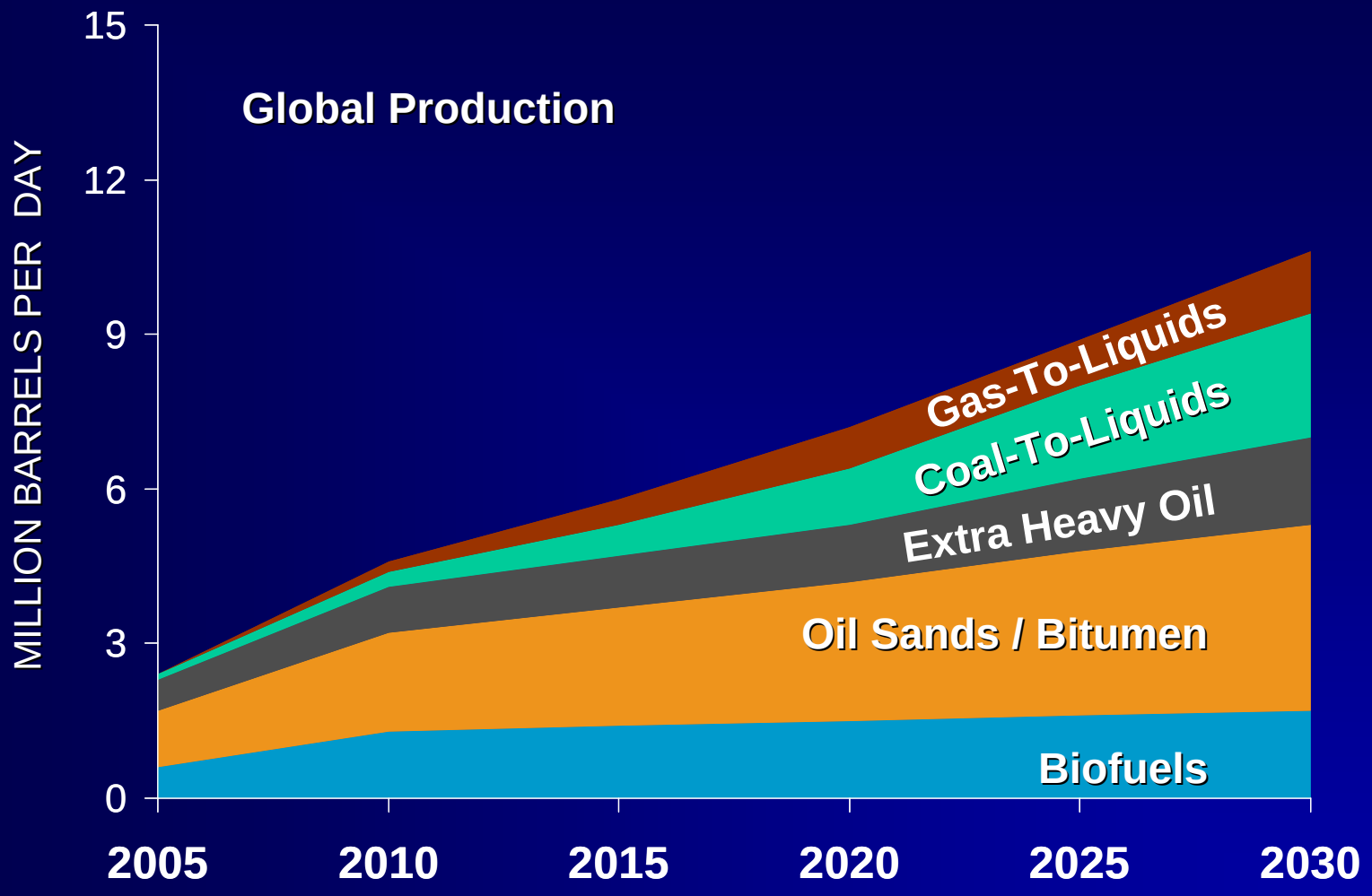



* Source: NPC Data Warehouse.

# The Hard Truth: Energy Sources

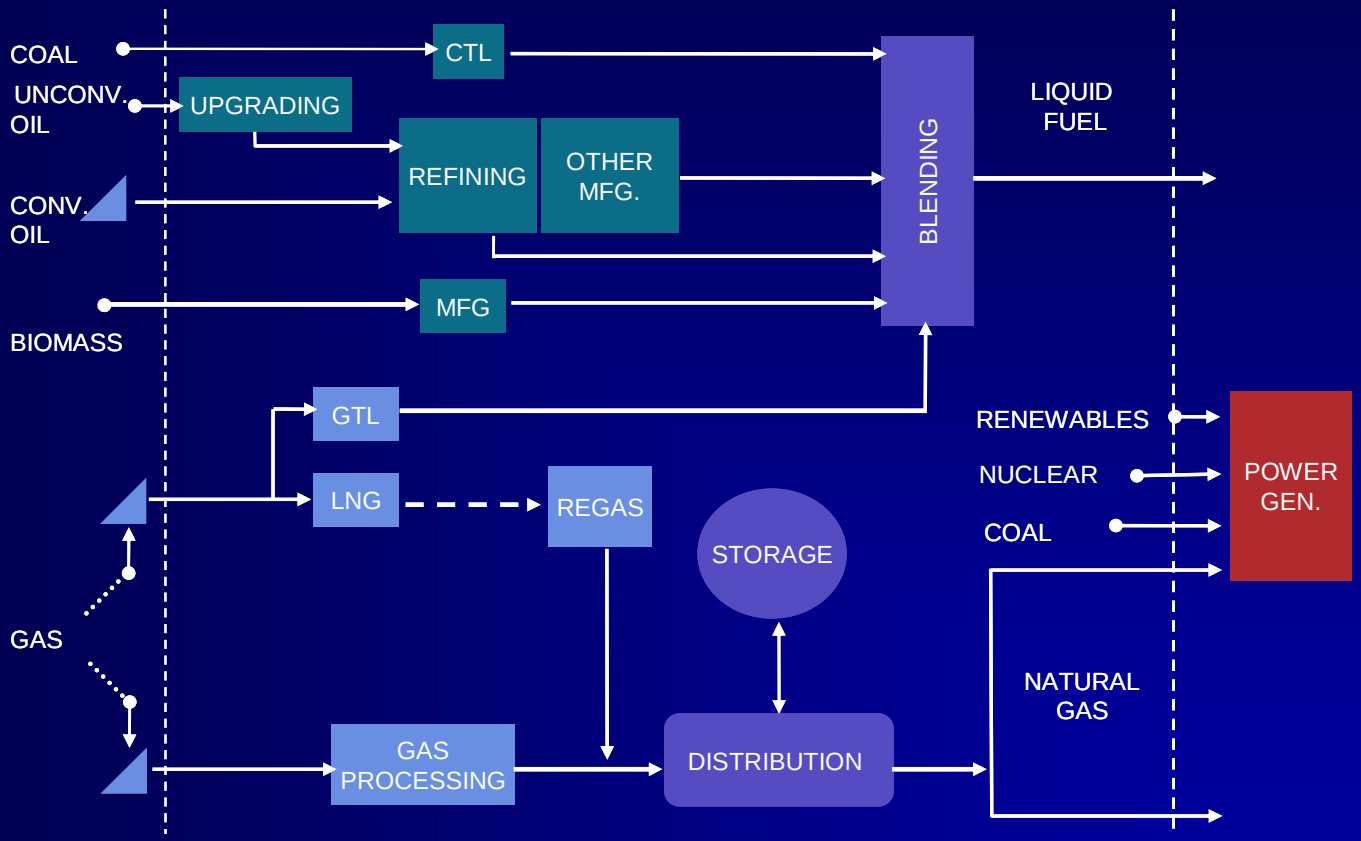
To mitigate these risks, expansion of all economic energy sources will be required, including coal, nuclear, biomass, other renewables, and unconventional oil and natural gas. Each of these sources faces significant challenges including safety, environmental, political, or economic hurdles, and imposes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

# Contribution of Unconventional Liquids




Source: Data From EIA 2007 Reference.

# Massive Infrastructure Investments Required



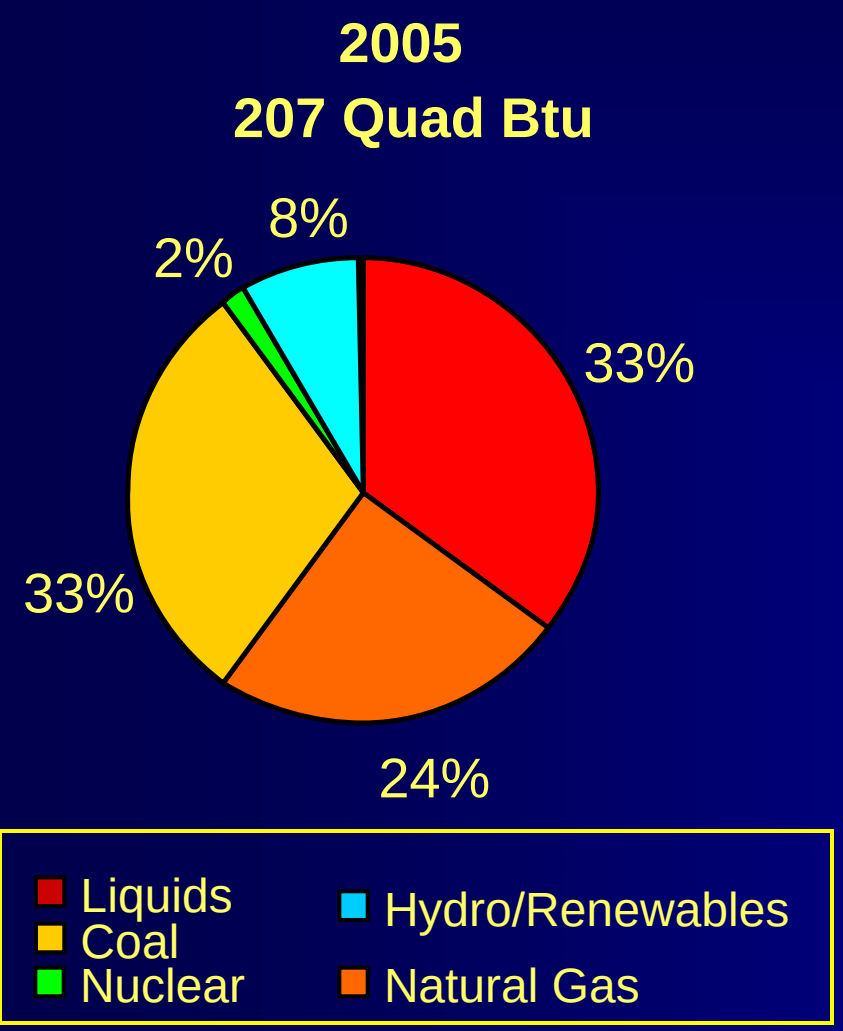
# The Hard Truth: Energy Security

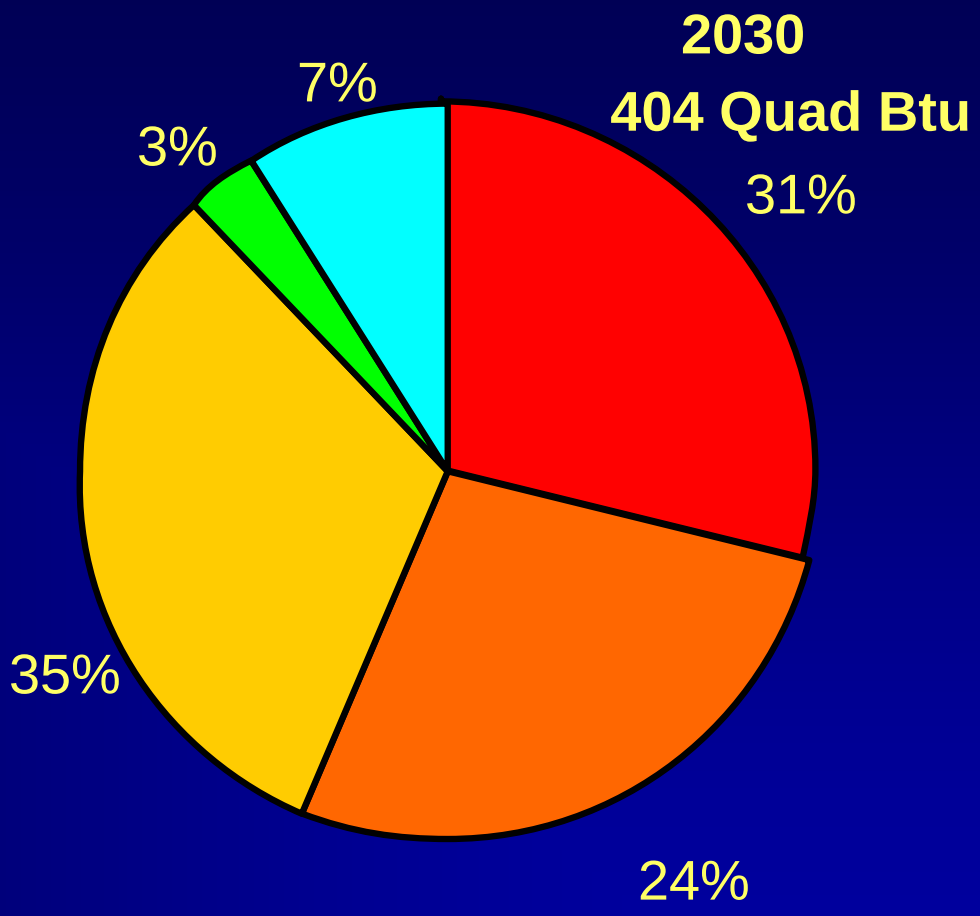
"Energy Independence" should not be confused with strengthening energy security. The concept of energy independence is not realistic in the foreseeable future, whereas U.S. energy security can be enhanced by moderating demand, expanding and diversifying domestic energy supplies, and strengthening global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

# *Evolving Energy World*

- Continued growth in global energy demand – increasingly from developing and emerging economies;
- Changing global energy map shows increased geographic concentration farther from major consumption centers;
- Resource endowment is enormous, but “Above Ground” issues present heightened & accumulating investment risks;
- Evolving market features new players with new agendas, new alliances and leverage; may require new tools and policy approaches;
- Projected impacts of climate change and carbon constraints are potential game changers

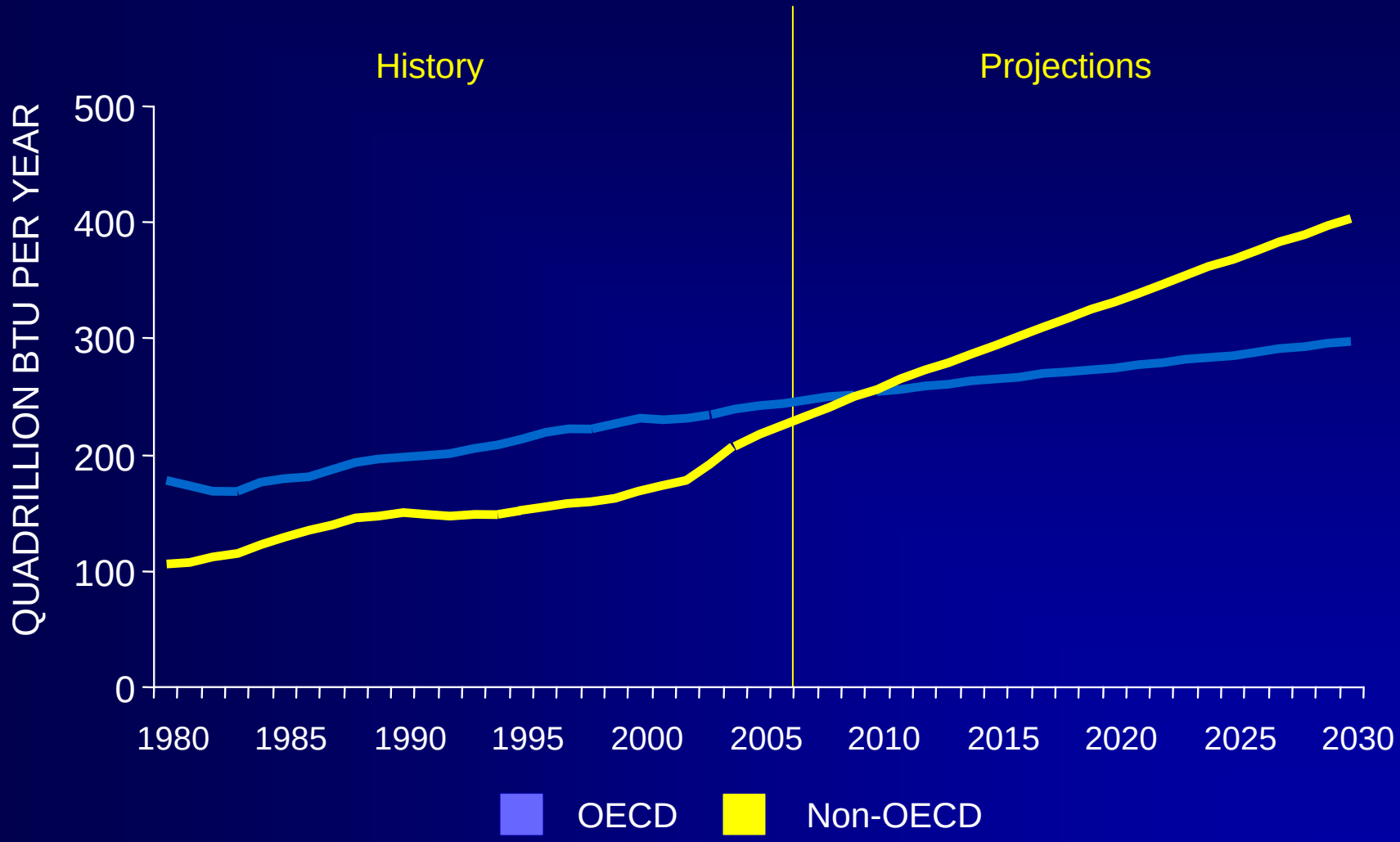
# Consumption in Developing World



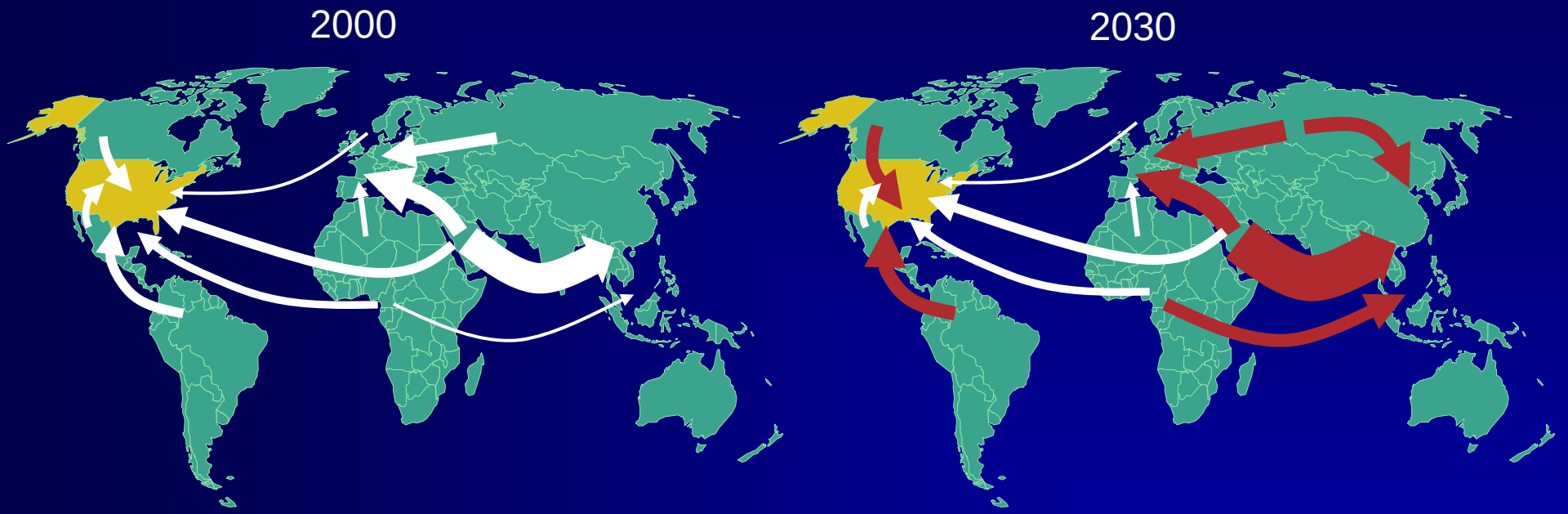

Source: EIA/IEO 2007

# ... And Energy Demand Growth Follows



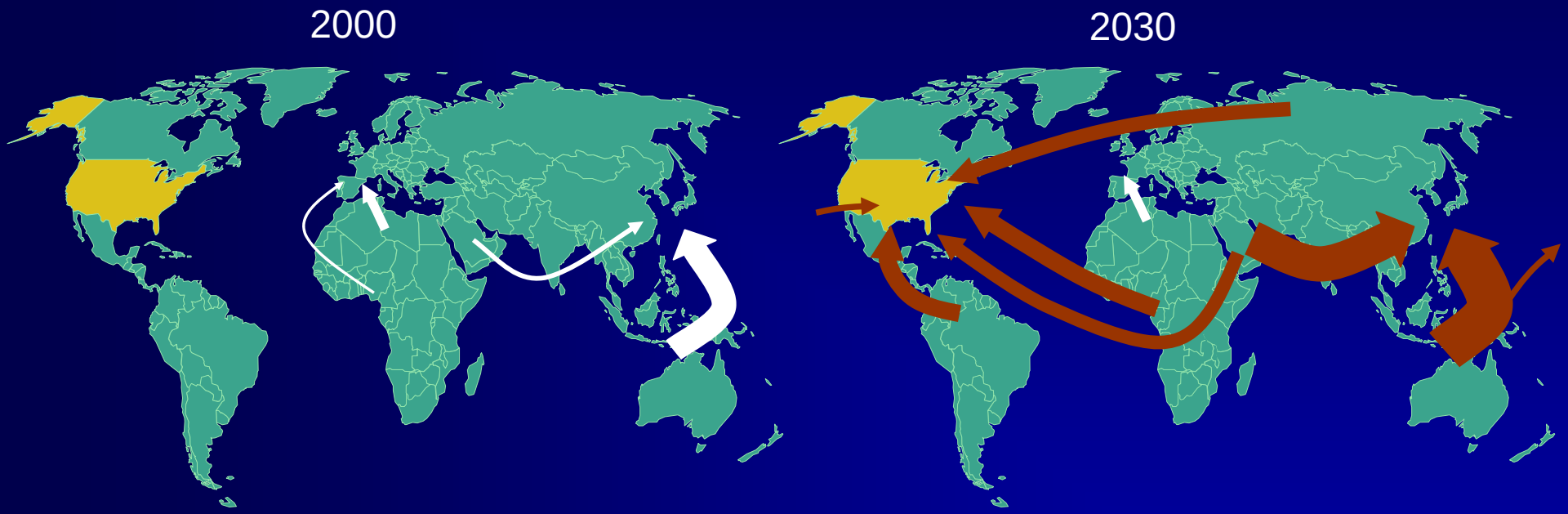

Source: EIA 2007

# Global Oil Trade




EXPANDING FLOW TRENDS

# Global LNG Trade




EXPANDING FLOW TRENDS

# Supply Vulnerability Zones

# New Considerations for Investment Decisions

## New "Above Ground" Challenges for Industry

- Role of new geopolitical alliances?
- Importance of supply reliability and price predictability
- Increased environmental sensitivity
- Global transformation - transitioning from bipolar world to multipolar world with rules as yet unwritten
- Power shift to areas with strategic commodities & rise in resource nationalism
- Human rights, distributive wealth, energy equity issues
- Terrorism – Threats to facilities and transit choke points
- Political Hostility to American Foreign Policy

# Broad Examination of Technology Themes

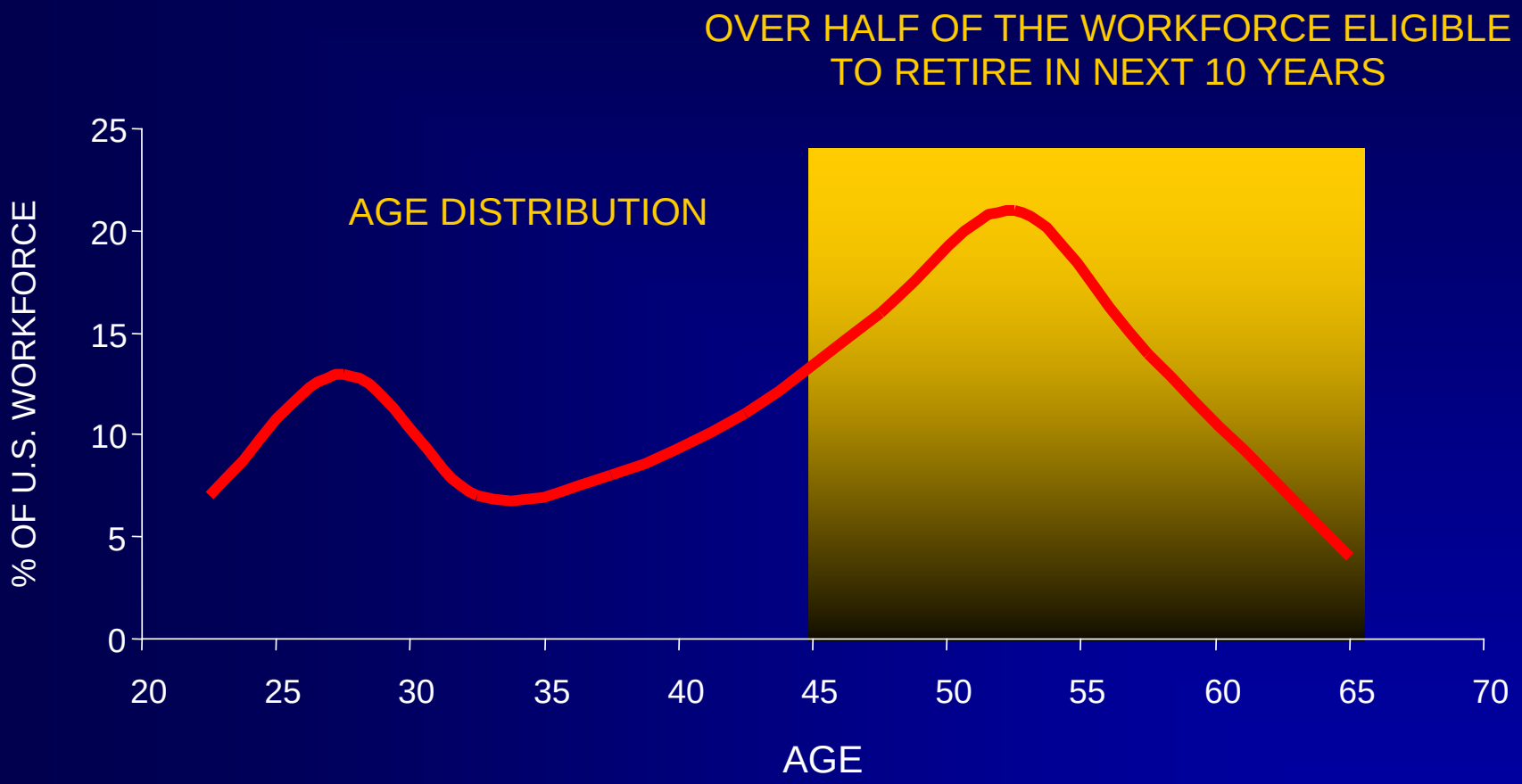
- Technology Development
- Personnel Issues: The Big Crew Change
- Carbon Management
- Conventional Resources (includes EOR and Arctic)
- Exploration Technology
- Deepwater Technology
- Unconventional Gas (including Coal and Shale gas)
- Heavy Oil and Bitumen
- Oil Shale
- Gas Hydrates
- Coal to Liquids 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 Truth: Workforce*

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




Source: U.S. Dept of Labor.

# *The Hard Truth: Carbon Emissions*

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

# $CO_2$ Emission Limits Will Alter Energy Strategies

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

# *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***

# *Moderate Demand Growth*

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

# 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

# *Promote 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 dialogue with major producers and consuming nations.

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

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.

# 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.

# 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:

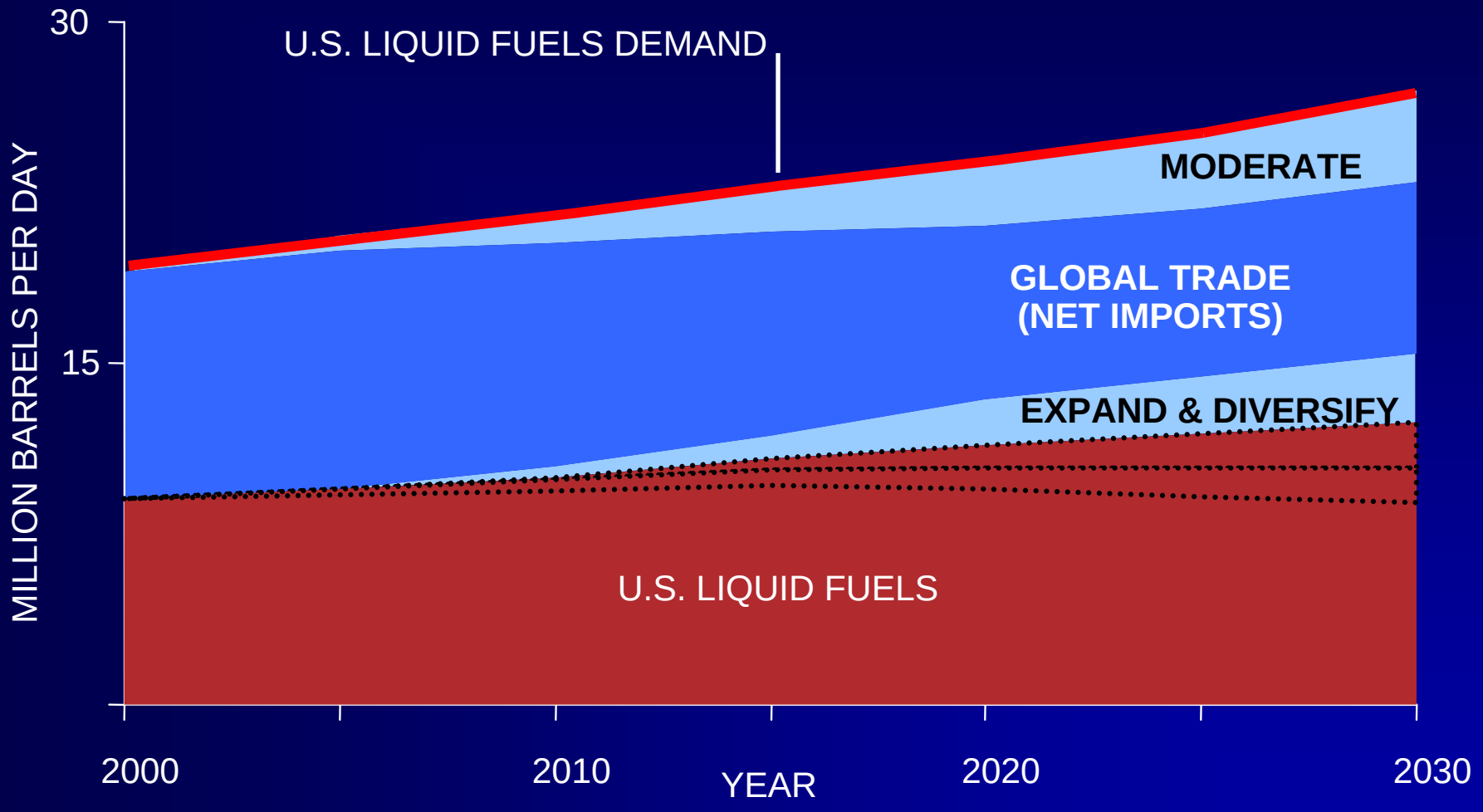
- Provide effective global framework for carbon management
- Establish transparent, predictable, economy-wide cost for $CO_2$ emissions

# *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

***For additional information or to register comments in connection with the NPC report: "Facing the Hard Truths About Energy"***

***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***