
Prudent Development

**Realizing the Potential of North America's Abundant
Natural Gas and Oil Resources**

**A Comprehensive Assessment to 2035
with Views through 2050**

**Senate Energy Staff
January 23, 2012**

National Petroleum Council (NPC)

- Origins** Continuation of WWII government / industry cooperation
- Purpose** Sole purpose of NPC is to advise U.S. Secretary of Energy and Executive Branch by conducting studies at their request
- Organization** A Federally chartered, self-funded Advisory Committee; Not an advocacy group, does not lobby
- Membership** Broad and balanced. Approximately 200 members from all segments of the oil and gas industries and many outside interests
- Study Participants** Diverse interests and expertise relating to the topic being addressed
- Study Reports** All NPC advice is provided in reports approved by its members and is available to the public. Reports can be viewed and downloaded at no cost from the NPC website – www.npc.org

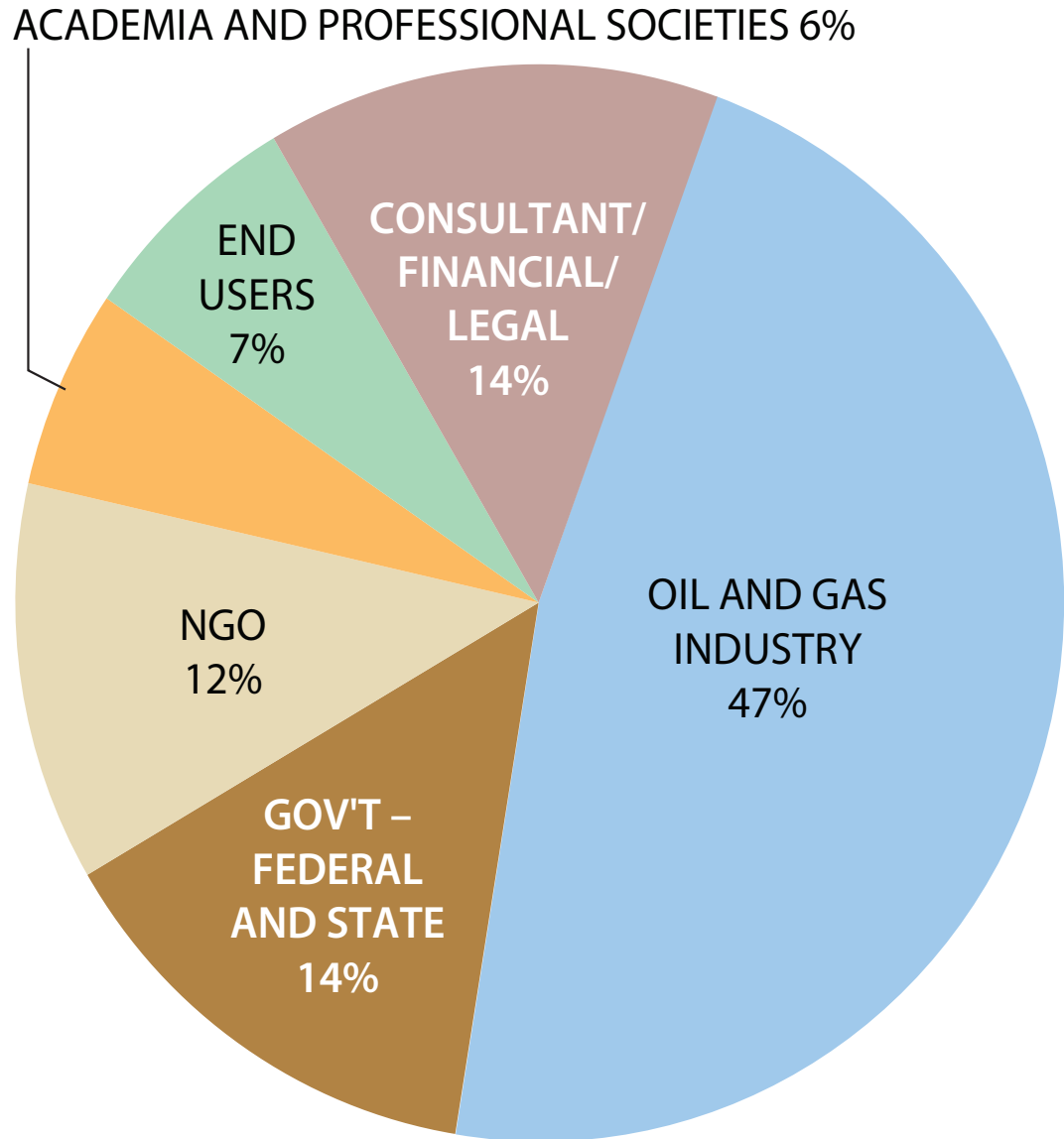
Prudent Development Study Objectives

- **Assess the N. American resource base – natural gas and oil**
 - Conventional
 - Unconventional
- **Describe the role of technology**
 - Environmental
 - Operational
- **Assess N. American supply and demand**
 - Through 2035
 - With a view to 2050
- **Identify the potential role of natural gas to lower emissions**
- **Meet national objectives: economic, environmental, security**

Diverse Study Participation

**Study Committee,
CSC,
Task Groups,
Subgroups**

**Over
400
Participants**



Four Major Findings

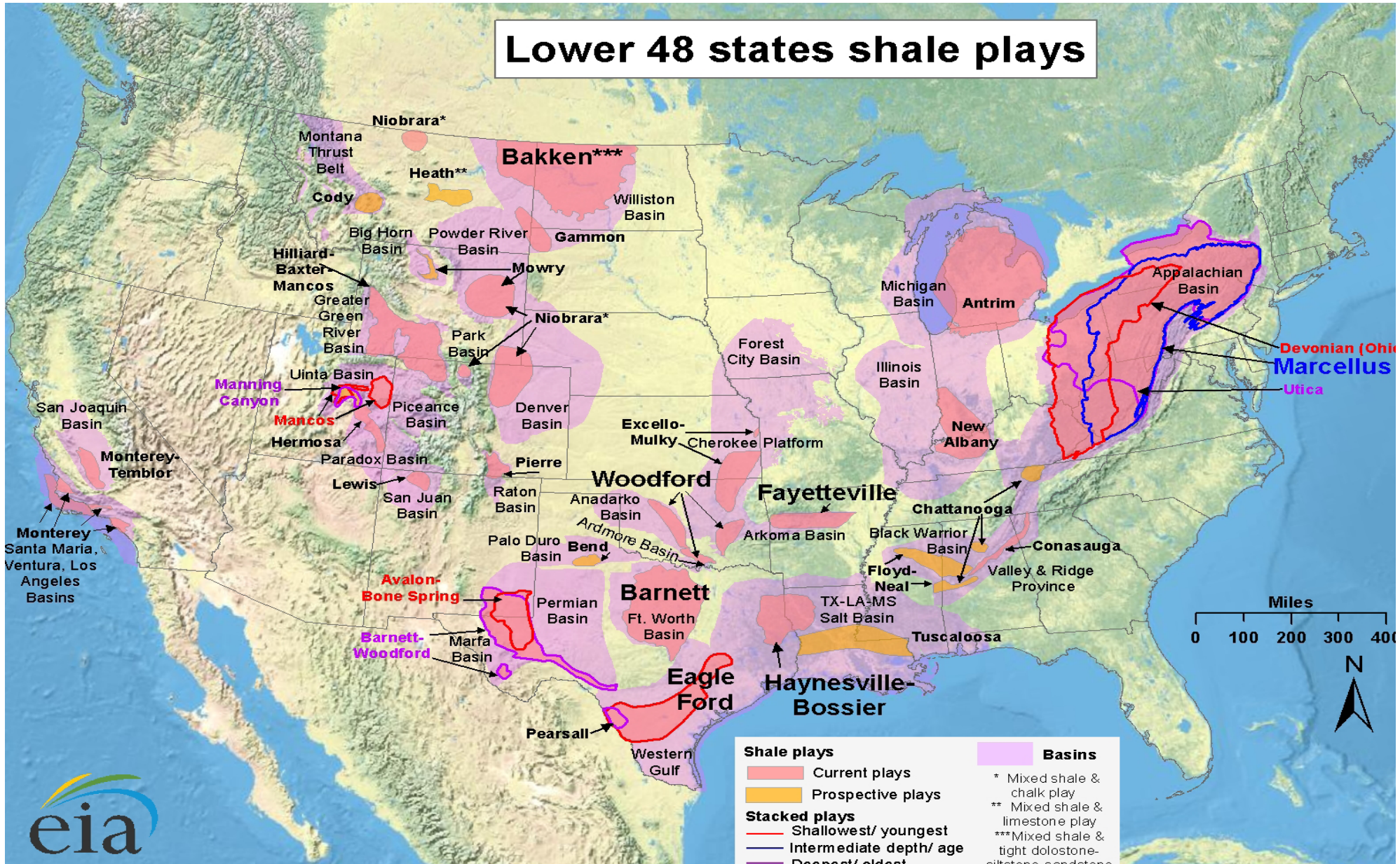
- **First, the potential supply of North American natural gas is far bigger than was thought even a few years ago**
- **Second – and perhaps surprising to many – America’s oil resources are also proving to be much larger than previously thought**
- **Third, we need these natural gas and oil resources even as efficiency reduces energy demand and alternatives become more economically available on a large scale**
- **Fourth, realizing the benefits of natural gas and oil depends on environmentally responsible development**

Core Strategies and Recommendations

- **Support prudent natural gas and oil resource development and regulation**
- **Better reflect environmental impacts in markets and fuel/technology choices**
- **Enhance the efficient use of energy**
- **Enhance the regulation of markets**
- **Support the development of intellectual capital and a skilled workforce**

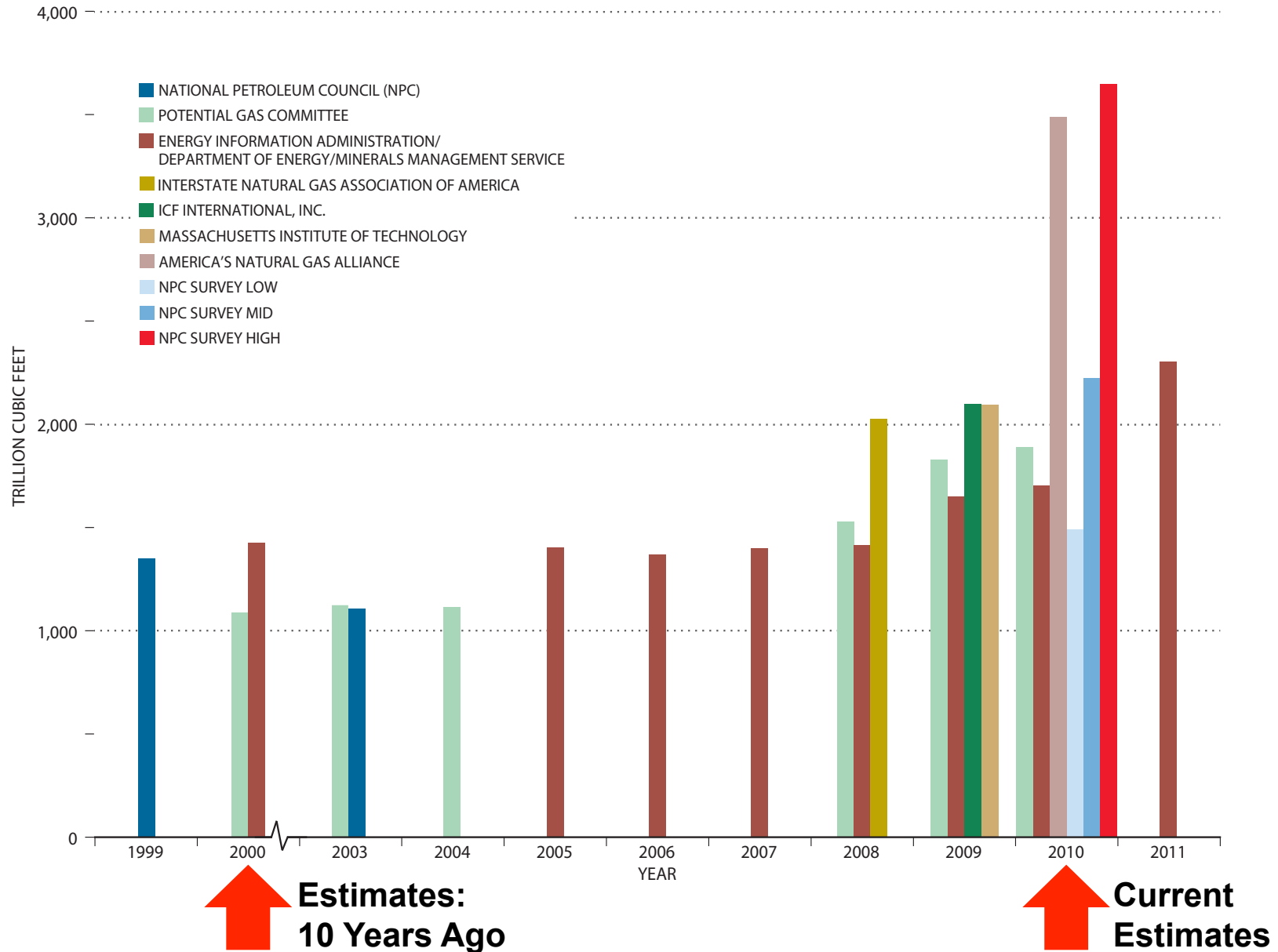
Benefits of Abundant Resources Require Prudent Development

Lower 48 states shale plays

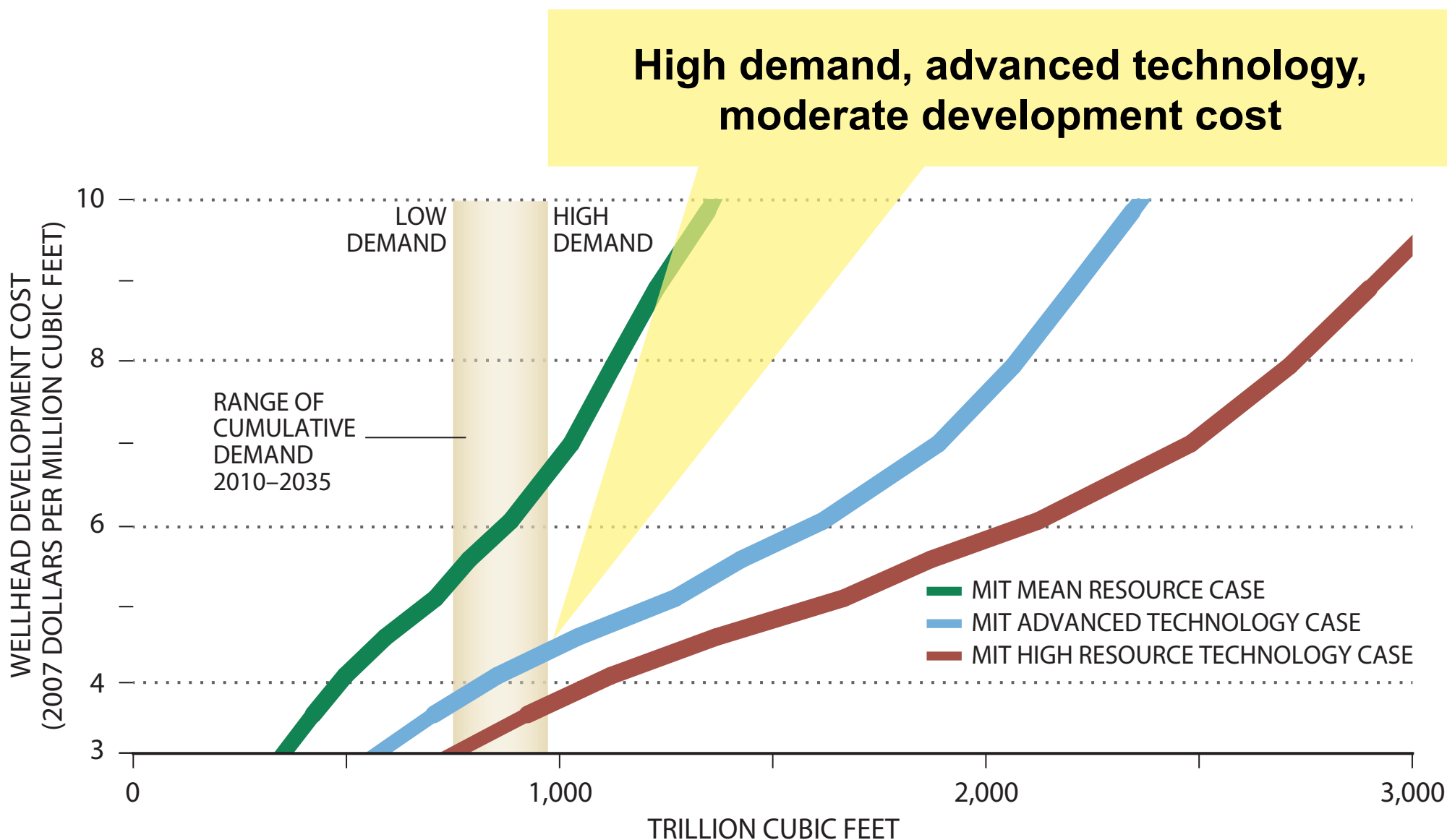


North American Natural Gas Resource Estimates have Transformed the Supply Outlook

Recent Estimates of Natural Gas Resources

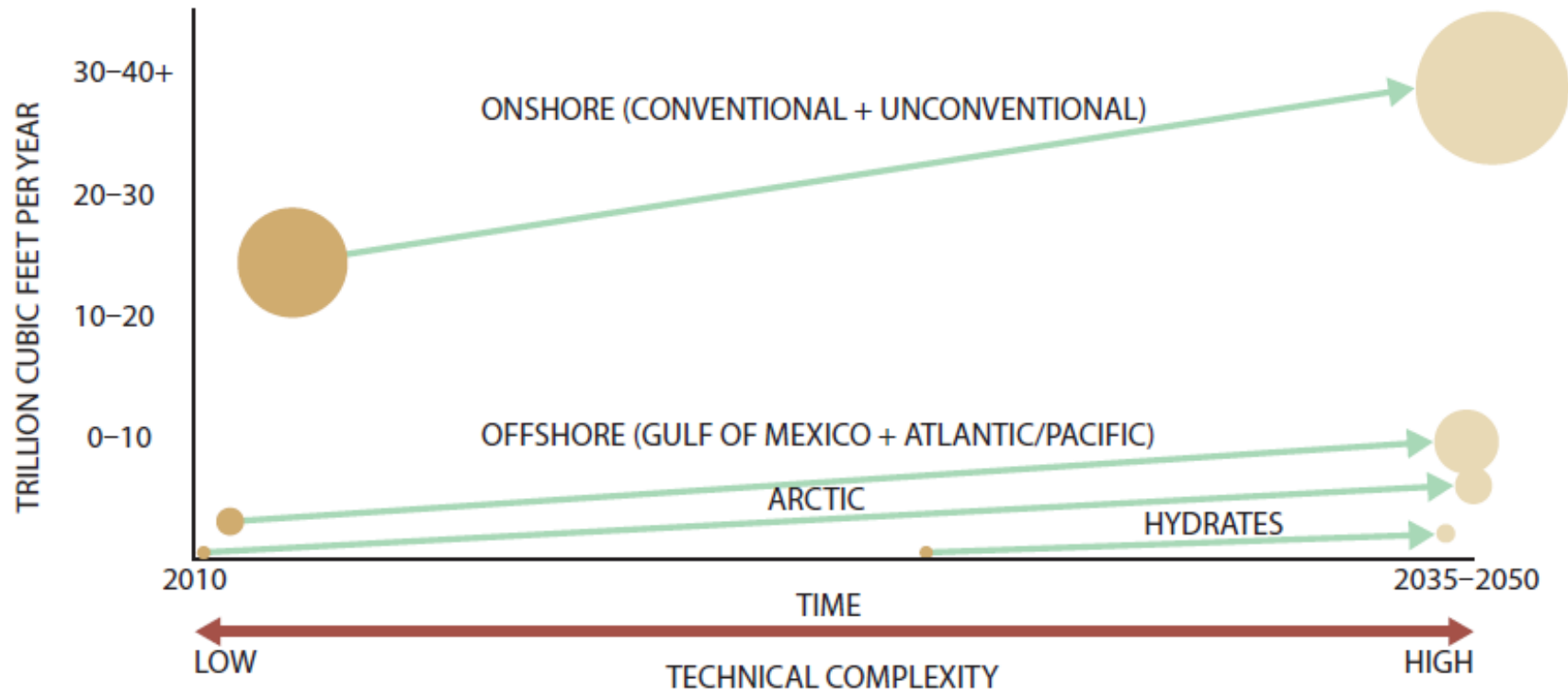


North American Natural Gas Resources Have Potential to Supply the Market for Decades

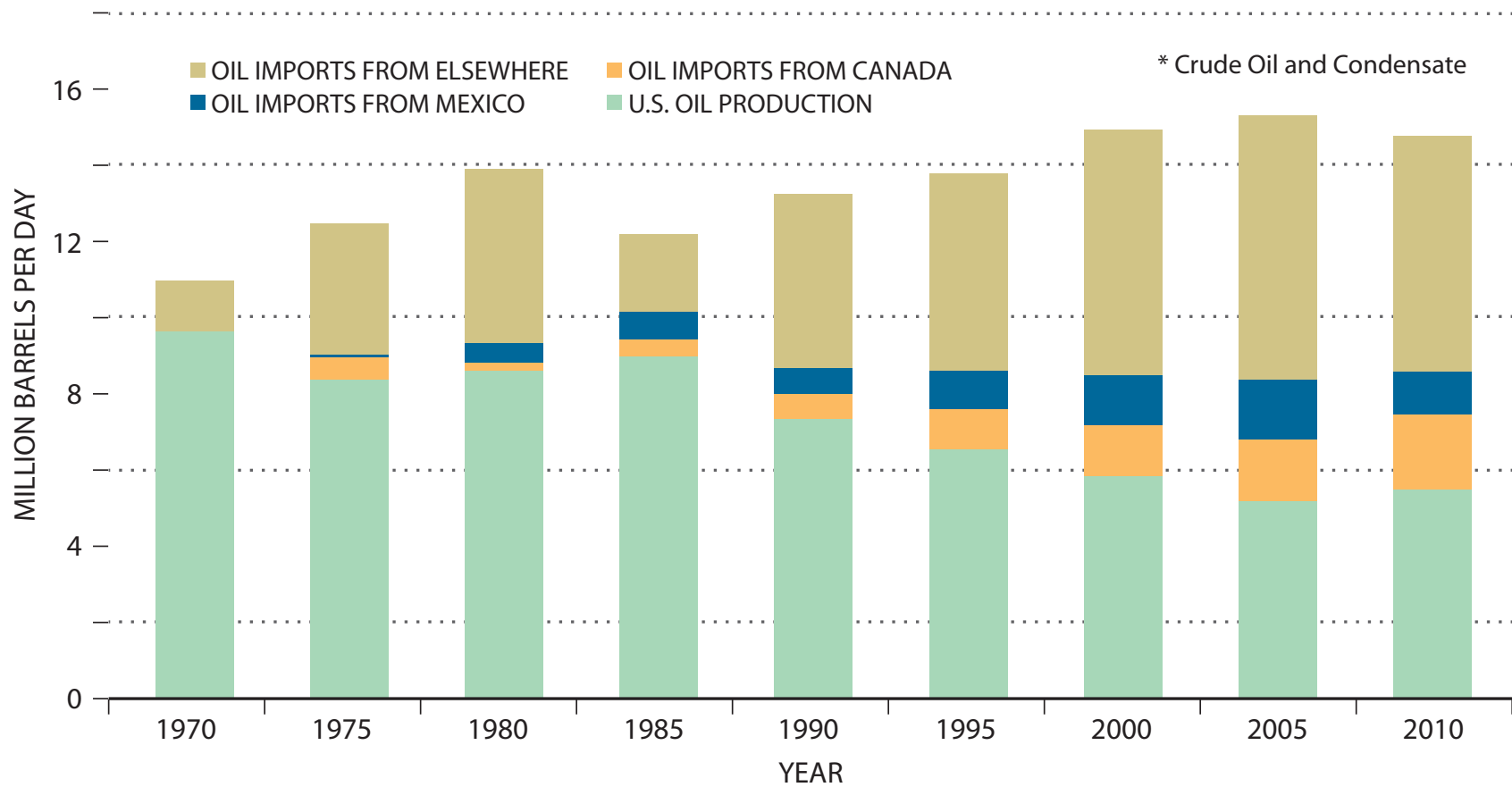


Natural Gas Production Potential can develop from a diversity of sources

Actual and Potential North American Gas Production Sources



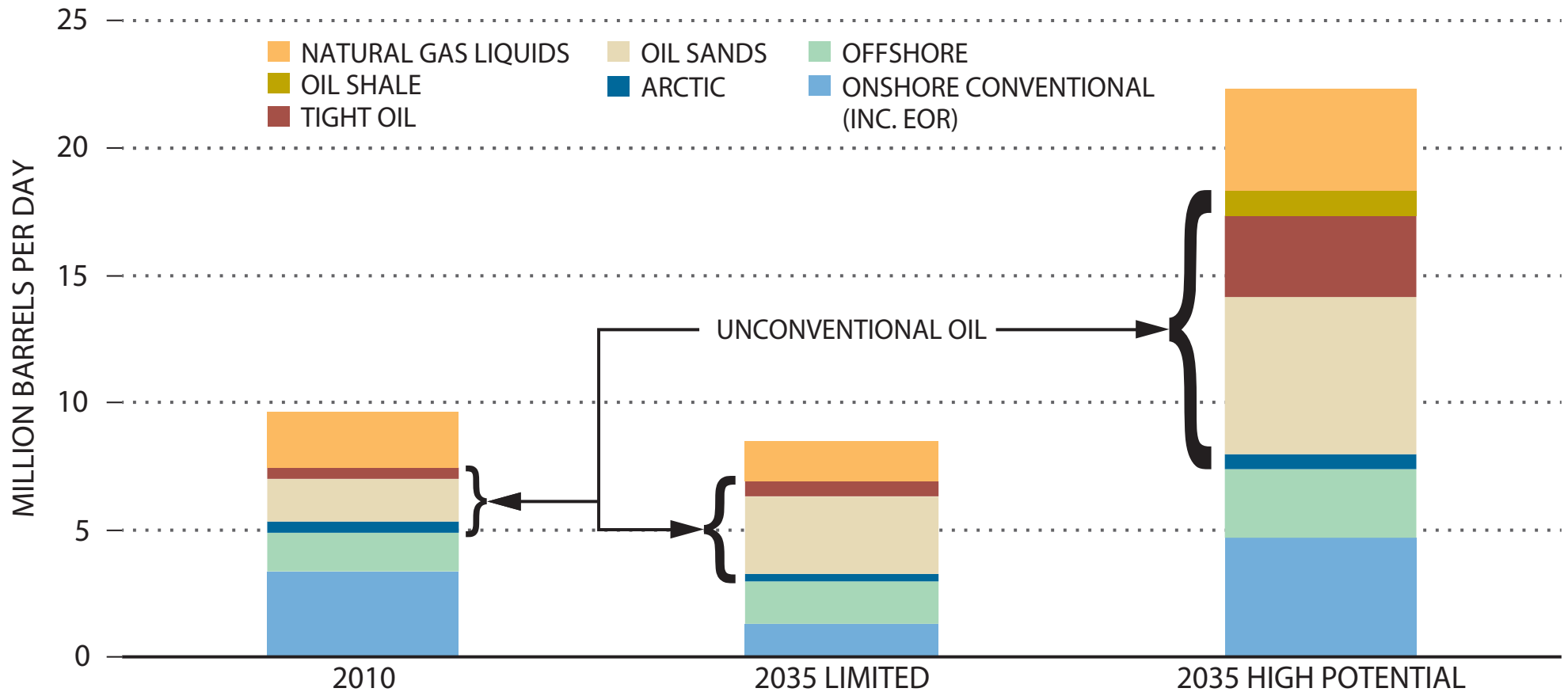
Crude Oil Production's Trend Reversal



Source: EIA AEO 2010 & IEO 2009.

N.A. Oil Supply Has Upside Potential But Risk of Decline

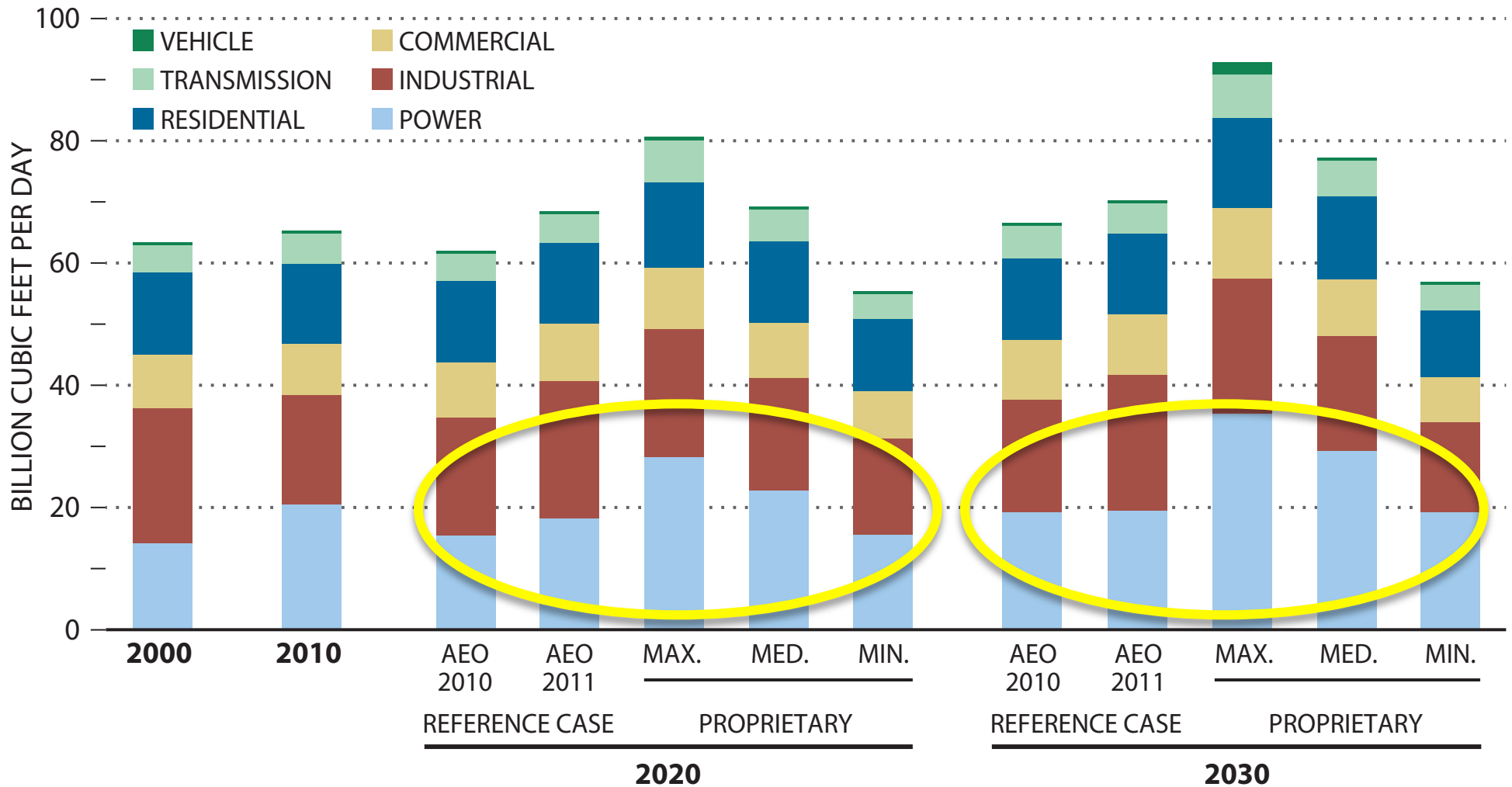
High production opportunities enabled by access frameworks



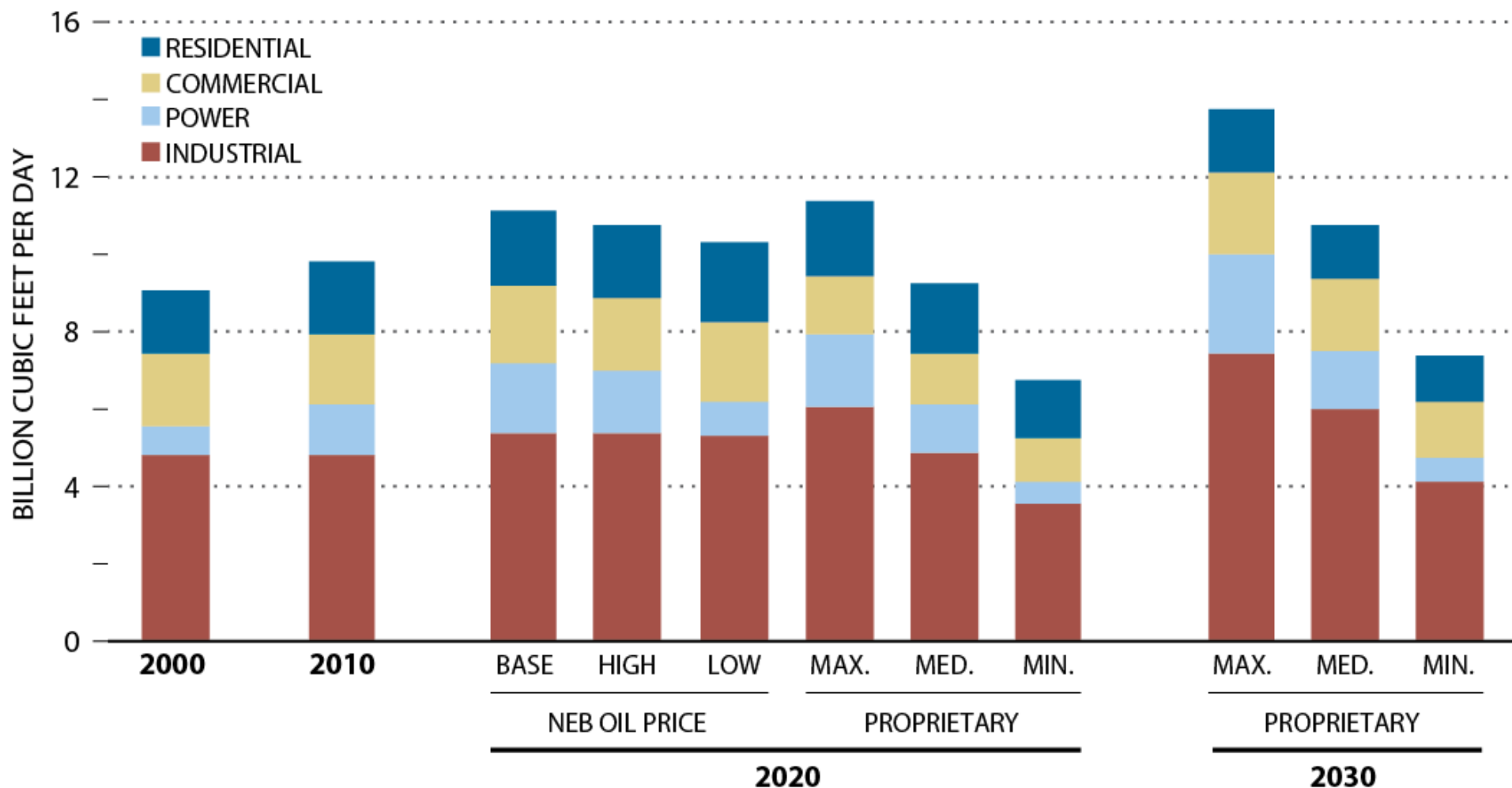
Natural Gas and Oil Have a Portfolio of Available Domestic Supply Options

- **In the near-term, currently commercial developments:**
 - Gulf of Mexico, Oil Sands, EOR, tight oil, onshore unconventional gas
- **In the medium-term, recognised high-potential areas with currently restricted access:**
 - Arctic, “new” offshore regions, plus all the above
- **In the long-term, resources which need new technologies and/or new access and regulatory regimes:**
 - Methane hydrates, shale oil (kerogen), U.S. oil sands, plus all the above
- **Medium and long-term options need sustained access, appropriate regulatory certainty, technology development and focus on environmental performance**
- **Pipeline, storage and processing facilities will need to expand to accommodate increased supply**

Power Sector Most Influences the Outlook for Natural Gas Demand



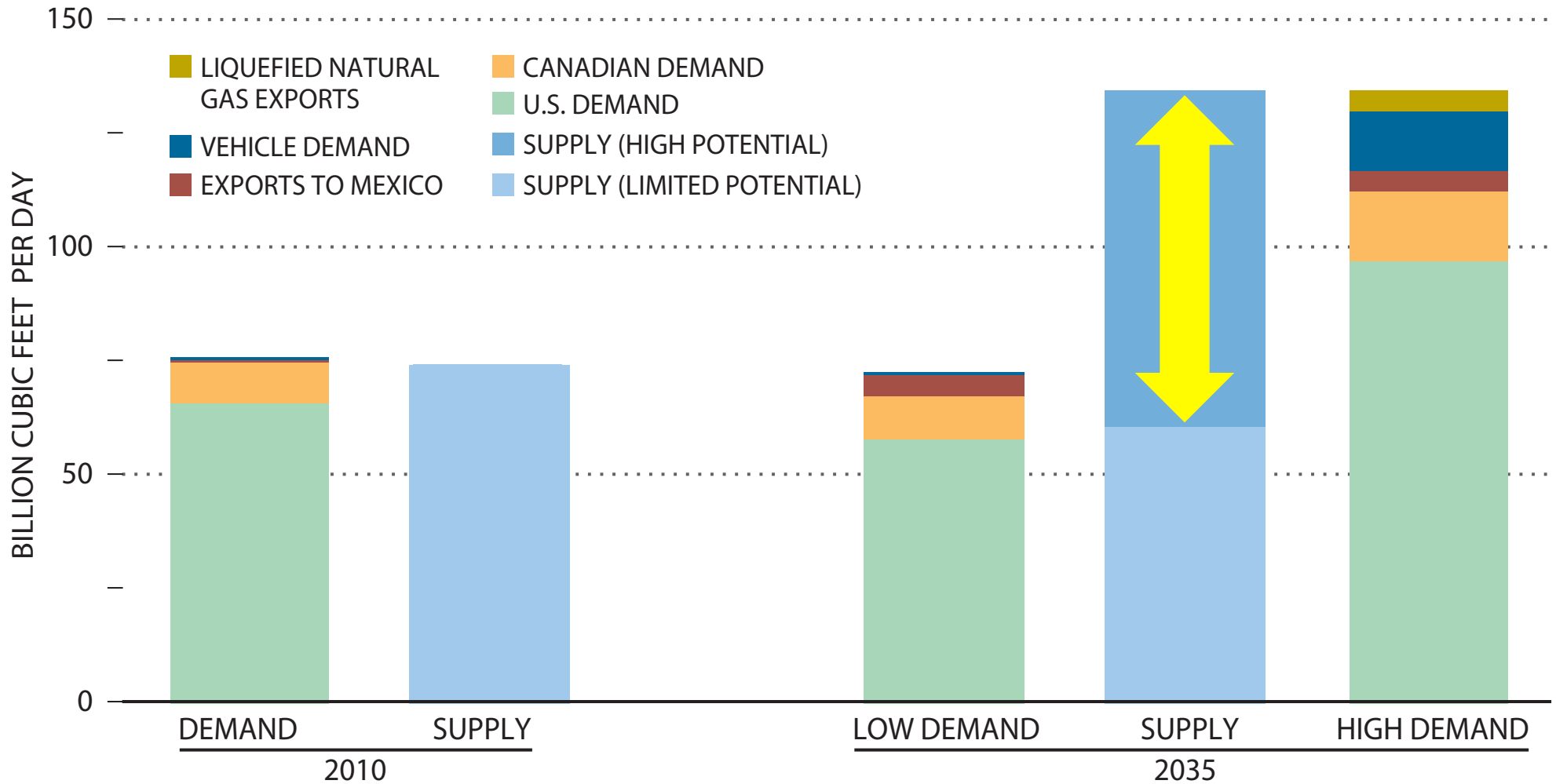
Wide Range of Canadian End Use Demand Projections



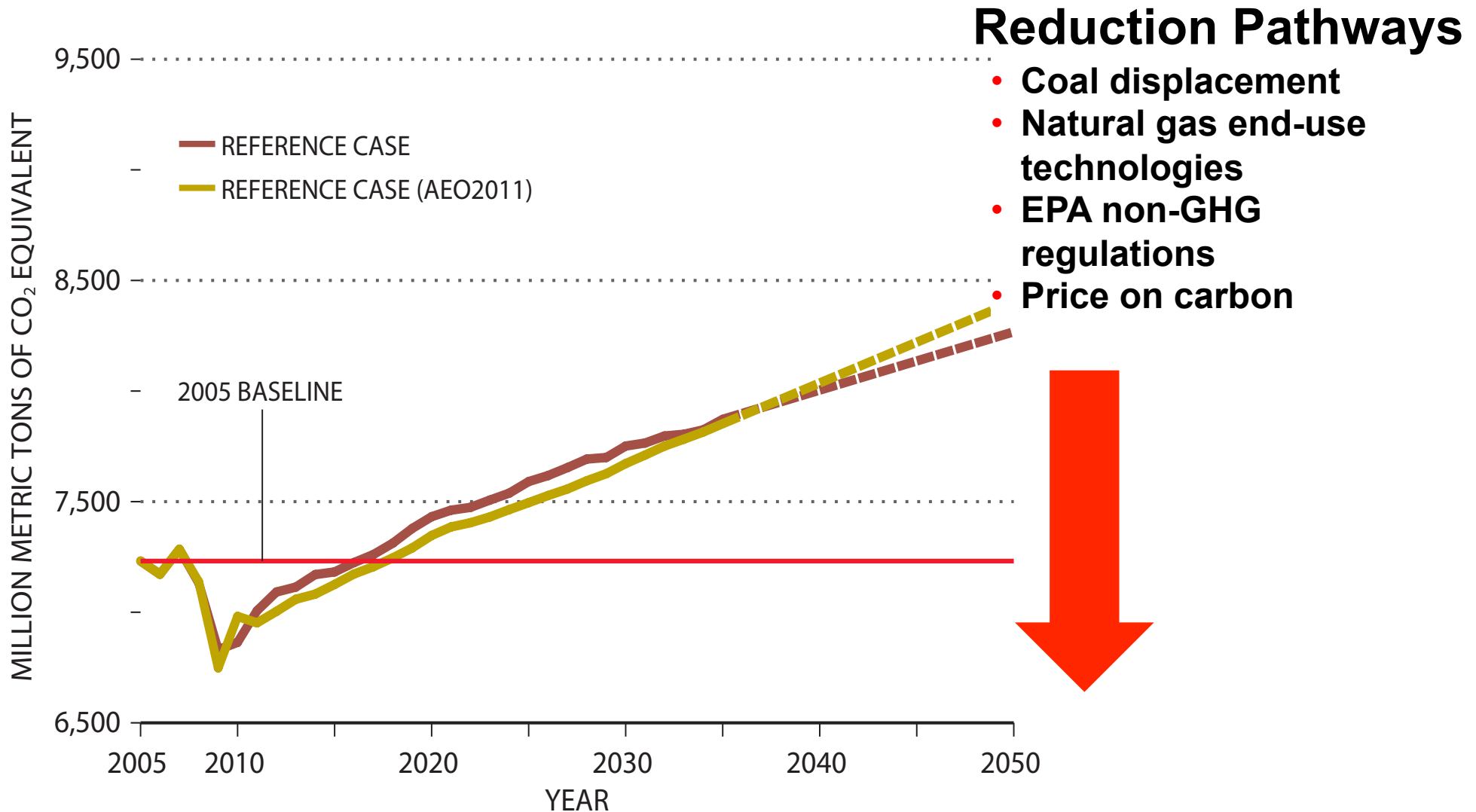
Source: NPC

Notes: NEB = National Energy Board 2009 Cases

North American Natural Gas Can Meet Even the Highest Potential Demand

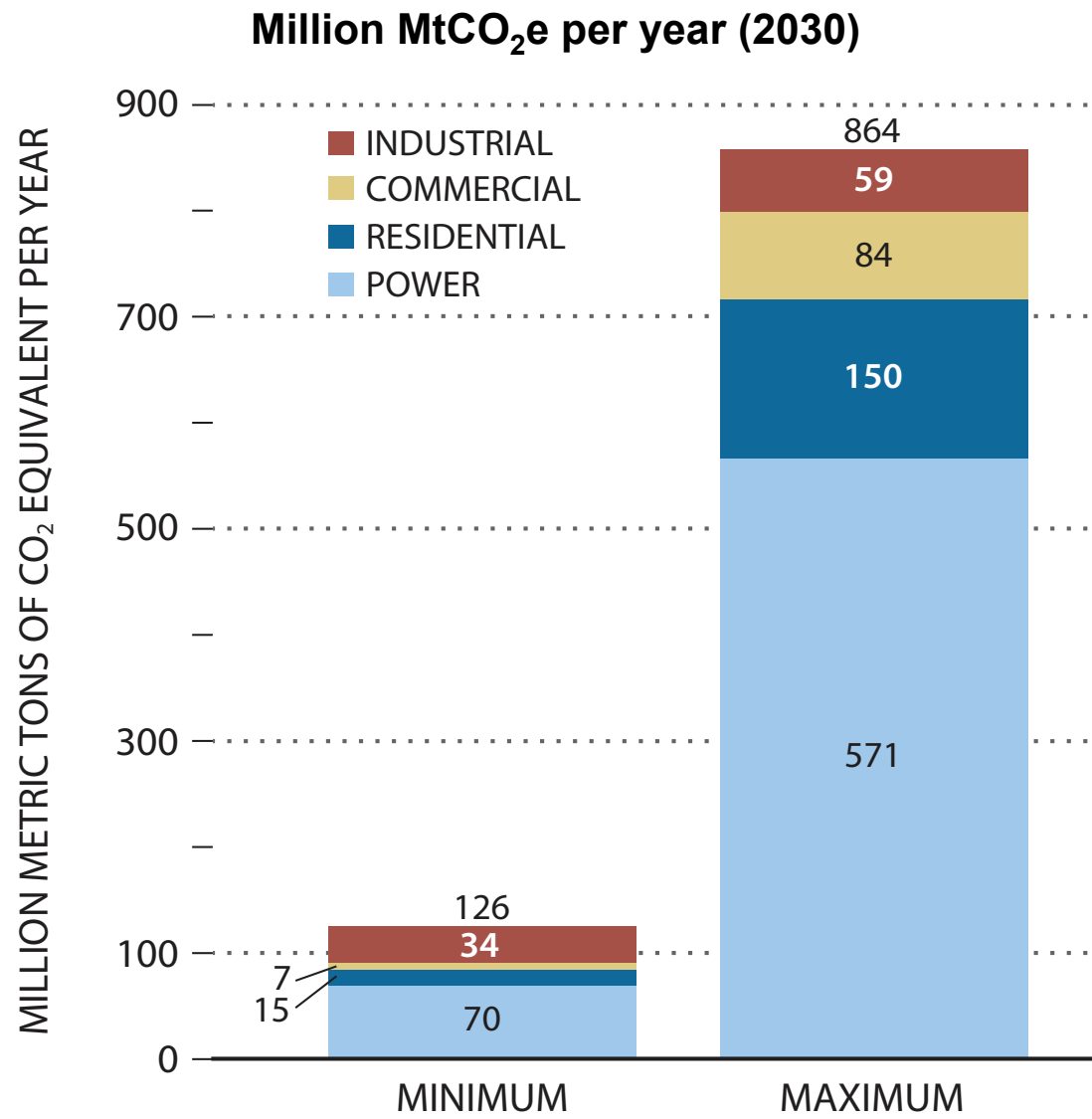


Greenhouse Gas Emissions



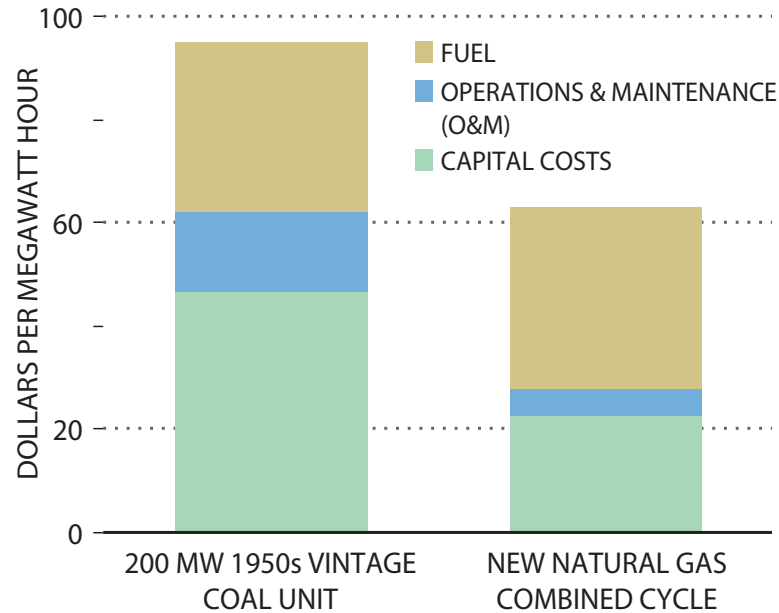
GHG Emissions Are Rising – But Natural Gas Can Be Part of the Solution to Help to Lower GHG Emissions

Range of Potential GHG Emissions Reductions in End-Use Sectors through Natural Gas Technologies



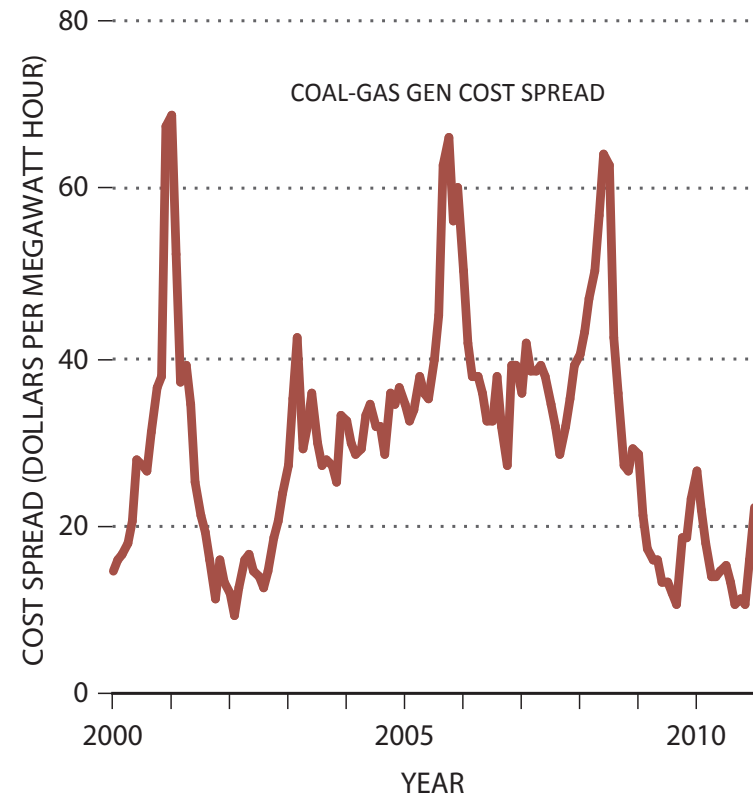
EPA non-GHG Rules – Coal Plant Retirement Decision

The spread between generating electricity from gas and coal has diminished.



Assumptions:

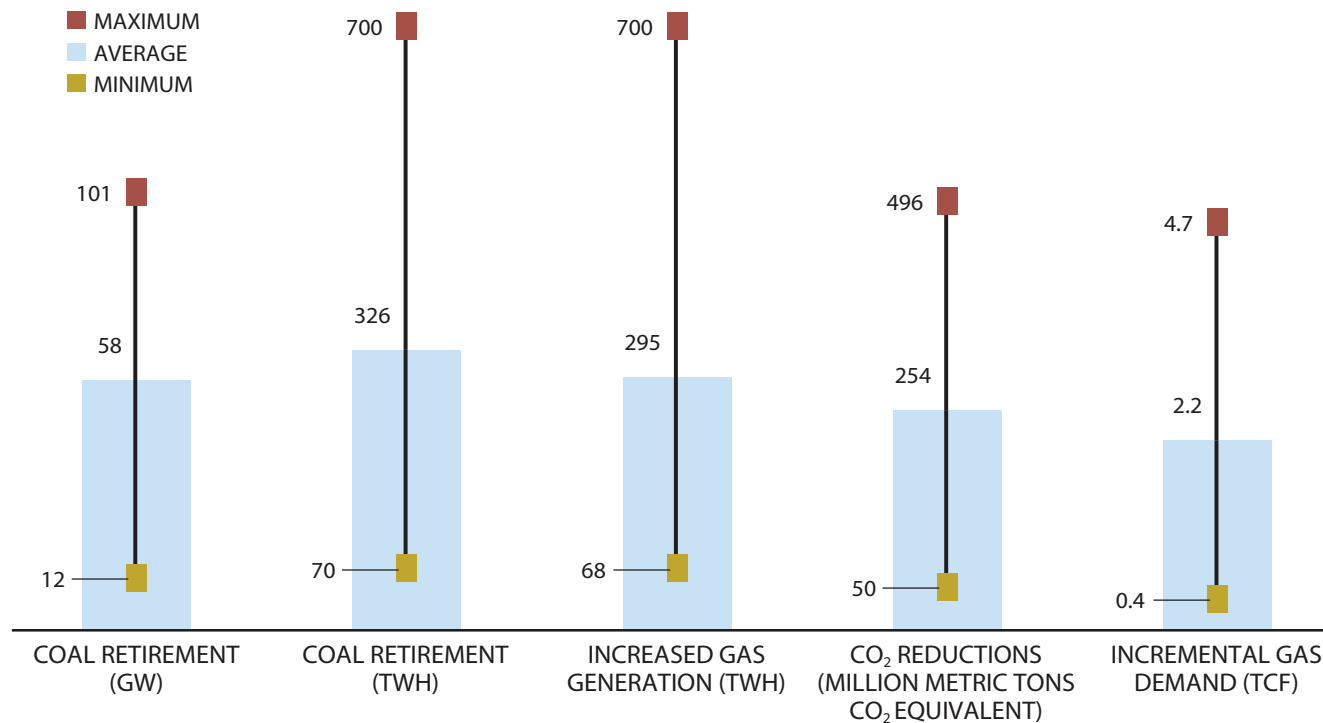
1. Retrofit and new build capital cost and O&M assumptions are from Environmental Protection Agency estimates.
2. Coal combustion residual (CCR) capital cost is from industry estimates.
3. Uncontrolled coal unit (200 MW) requires flue gas desulfurization (FGD) + selective catalytic reduction (SCR) + CCR: Capital cost – ~\$1,450/kW; retrofit life – 15 years; 11,000 Btu/kWh heat rate; \$3/million Btu coal price.
4. Natural gas combined cycle: Capital cost – ~\$1,000/kW; life – 30 years; 7,000 Btu/kWh heat rate, \$5/million Btu gas price.



Impact of EPA non-GHG Rules

Impact of non-GHG EPA Rules on Coal Plants Averages 58 GW of Retirements (~18% of the 316 GW of Total U.S. Coal-Fired Generation Capacity)

Summary of Results – Average, Maximum, and Minimum Values across All Studies



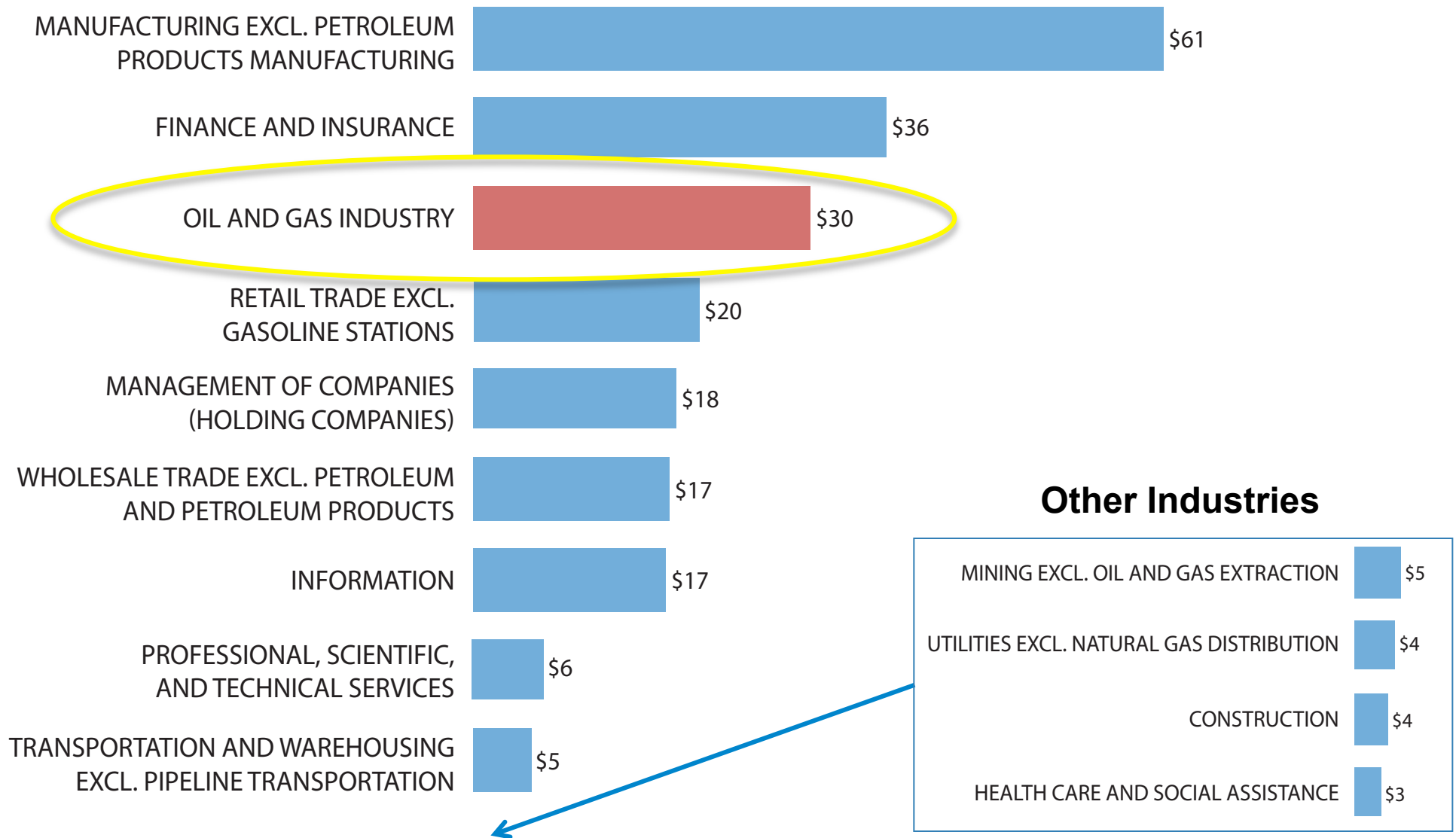
Favorable fuel prices and pending non-GHG rules may improve natural gas-fired power plants' relative economics and greatly influence a power company's decision to retire or retrofit its coal plants.

Emissions Related Recommendations

- **Provide regulatory certainty to the power sector on the EPA non-GHG rules**
- **Use industry-government partnerships to promote technologies, protocols, and practices to measure, estimate, report, and reduce emissions of methane in all cycles of production and delivery**
- **As policymakers consider energy and environmental policies, they should consider effective and efficient methods to internalize the cost of carbon impacts**
 - Policies should be national, economy-wide, market-based, and part of an effective global framework
- **Keep option for deep reductions of GHG emissions through lower emitting technologies or Carbon Capture and Sequestration (CCS) R&D that is fuel neutral**

Other Benefits: Industry Payments of Federal Corporate Income Taxes

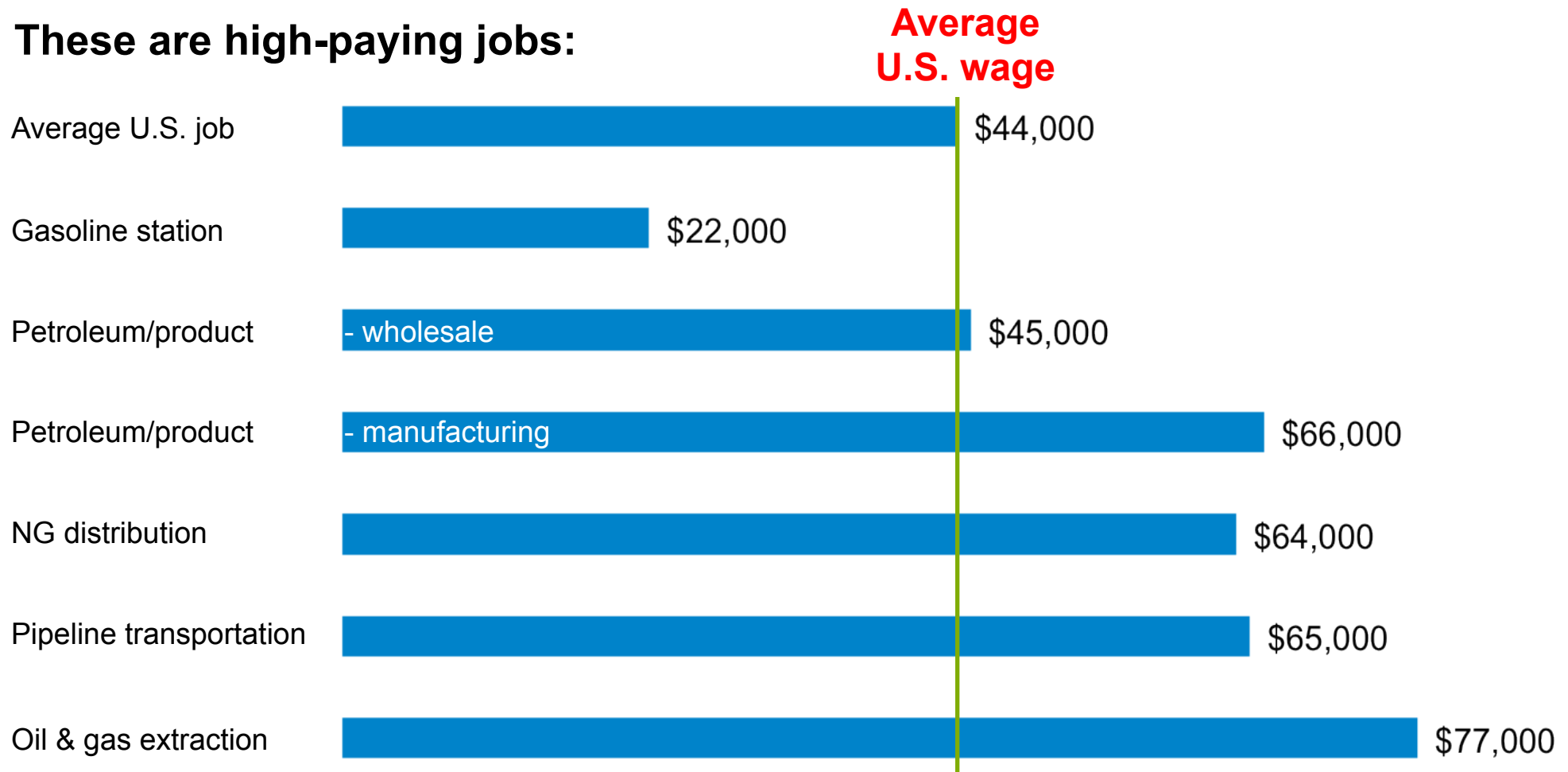
2008 Federal income taxes paid by corporations (IRS) (\$Billions)



Economic Benefits Also Flow From More Domestic Gas & Oil Development

- Direct jobs in the oil & gas industry: 2+ million
- Total direct/indirect jobs from oil & gas industry activity: 9+ million

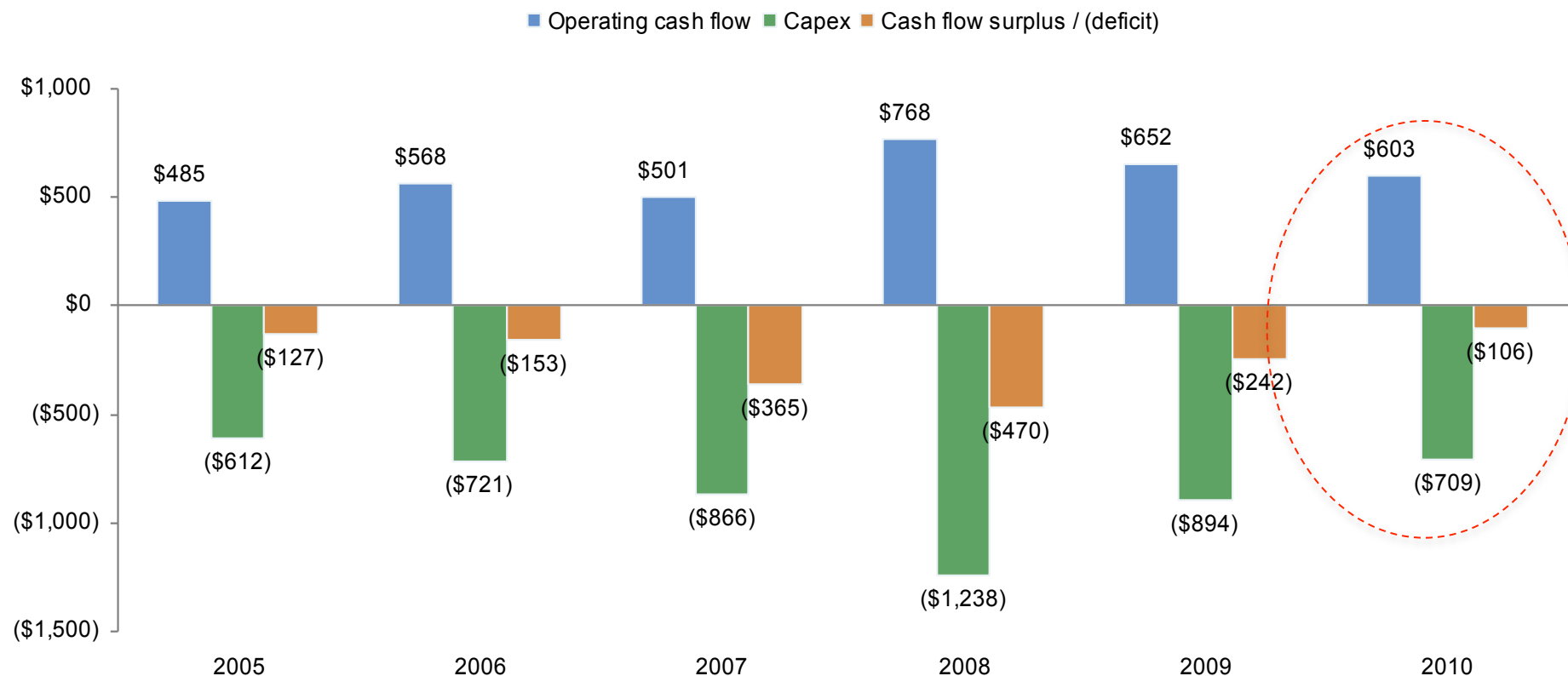
These are high-paying jobs:



Natural Gas And Oil Companies Reinvest Their Cash Flow To Grow Production And Reserves

Average cash flows for U.S. E&P companies with market cap from \$1-10 billion

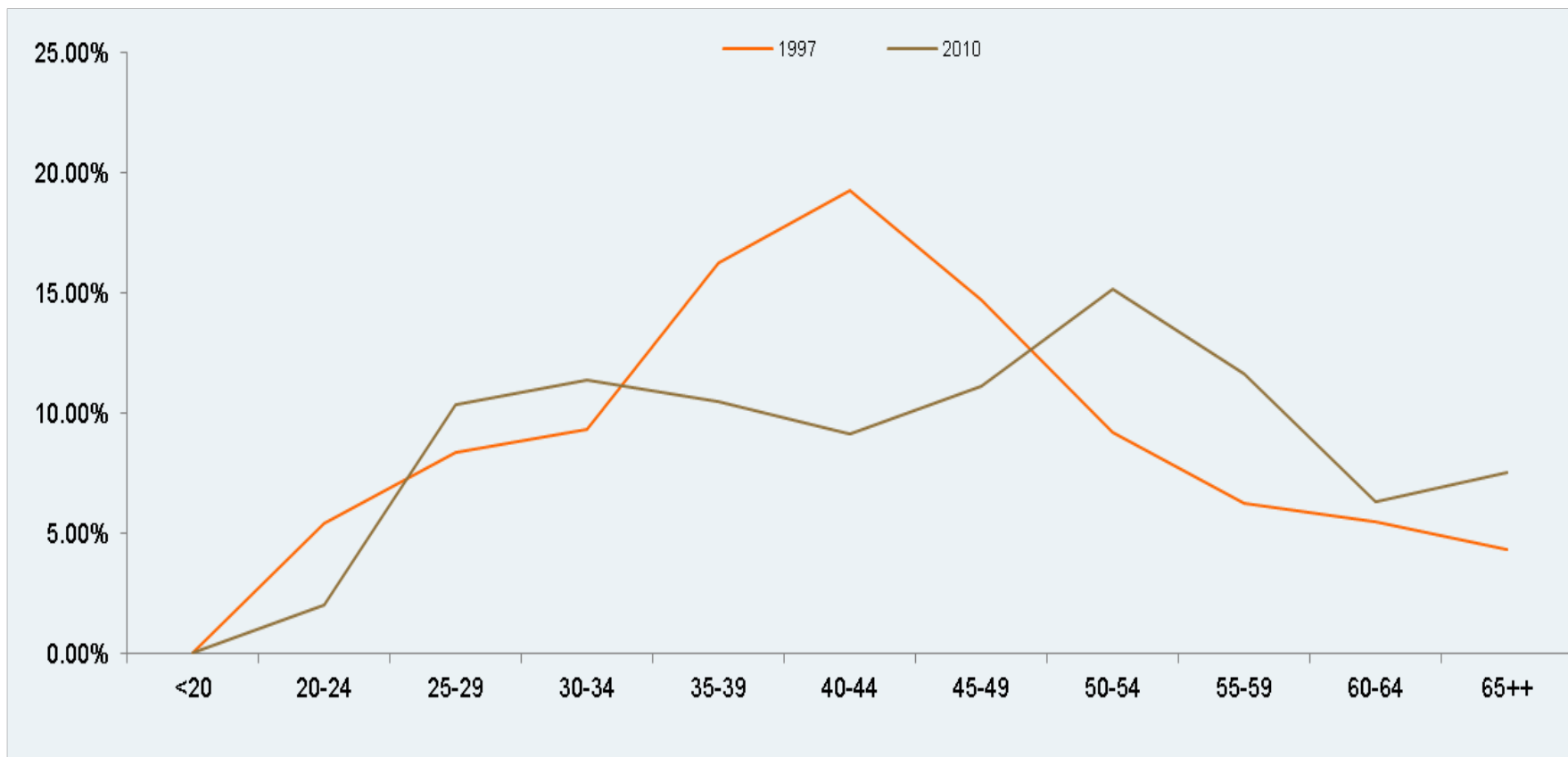
(Amounts in \$mm)



Many technical professionals are reaching retirement age

- The oldest Baby Boomers turn 65 this year, highlighting the demographic change under way in the natural gas and oil industry (and other industries)

Age distribution of Society of Petroleum Engineers membership



Prudent Development

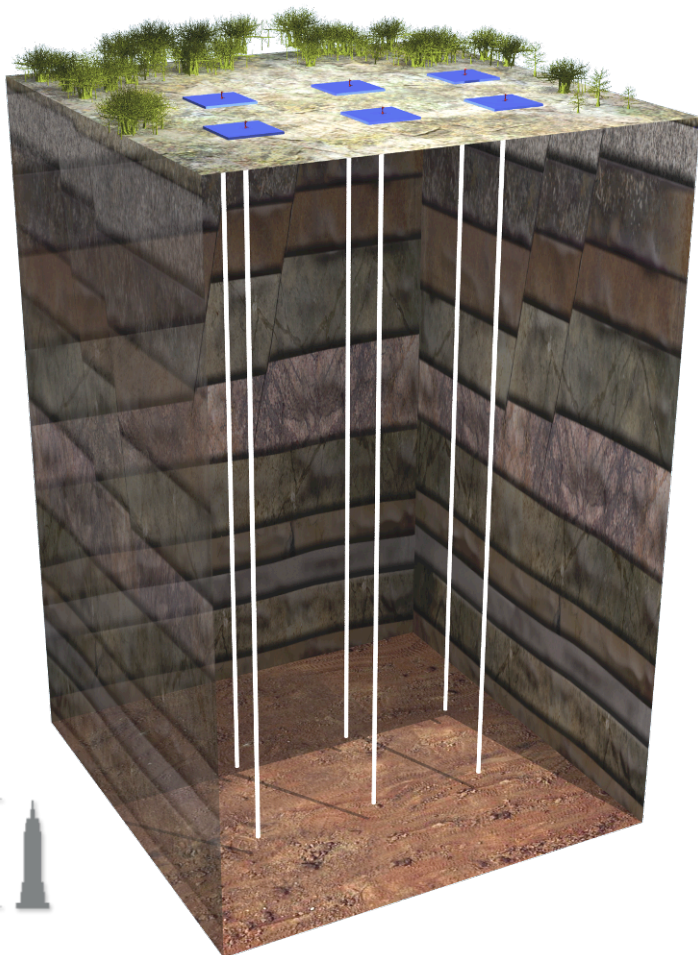
In order for the U.S. to realize the benefits of substantial resource abundance, development must be done prudently.

Prudent development is:

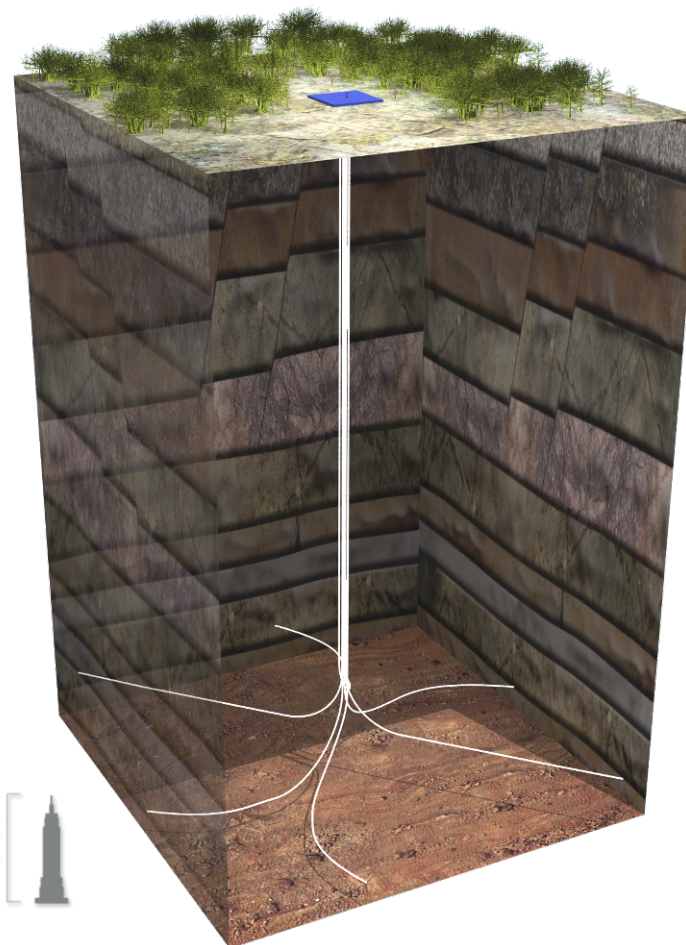
- **Essential for public trust and confidence**
- **Required for continued and expanded access**
- **Fundamental for long term industry success**

Responsible Surface Use

**Traditional development
with vertical wells requiring
one pad site per well**

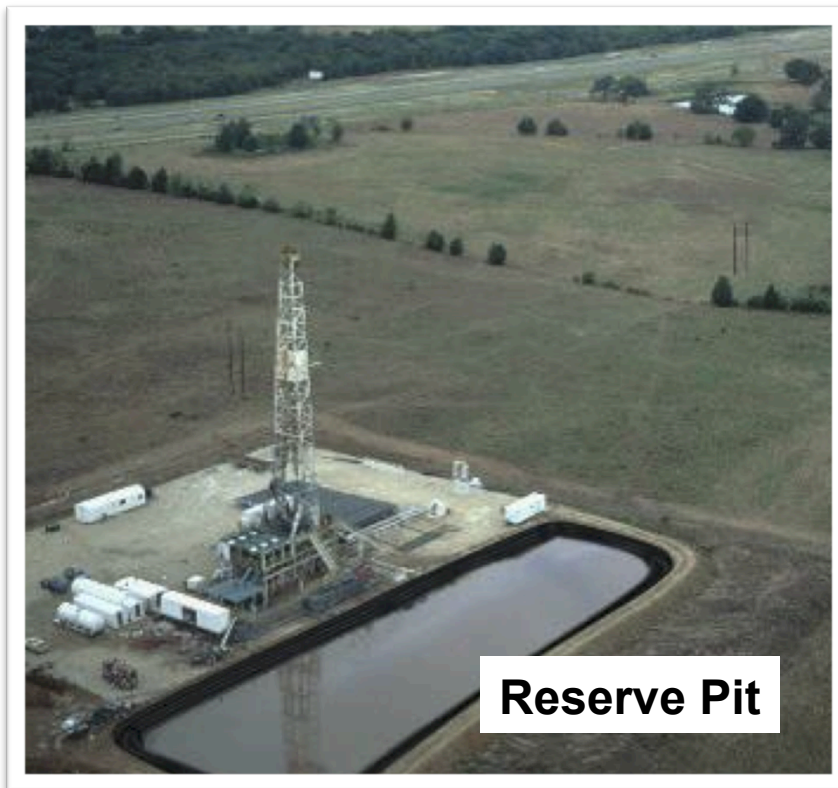


**Multi-well development
minimizing surface use with 6-12
wells drilled from a single pad site
(surface disturbance <2%)**



Closed Loop Drilling Fluid System

Open Loop System



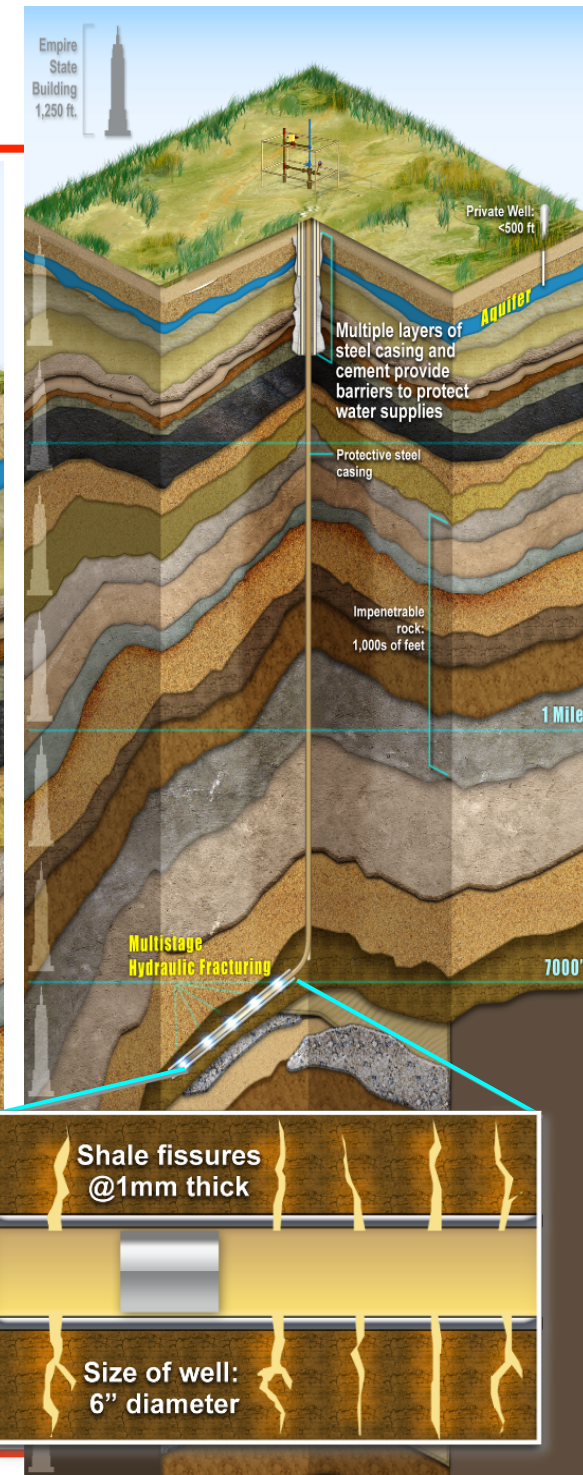
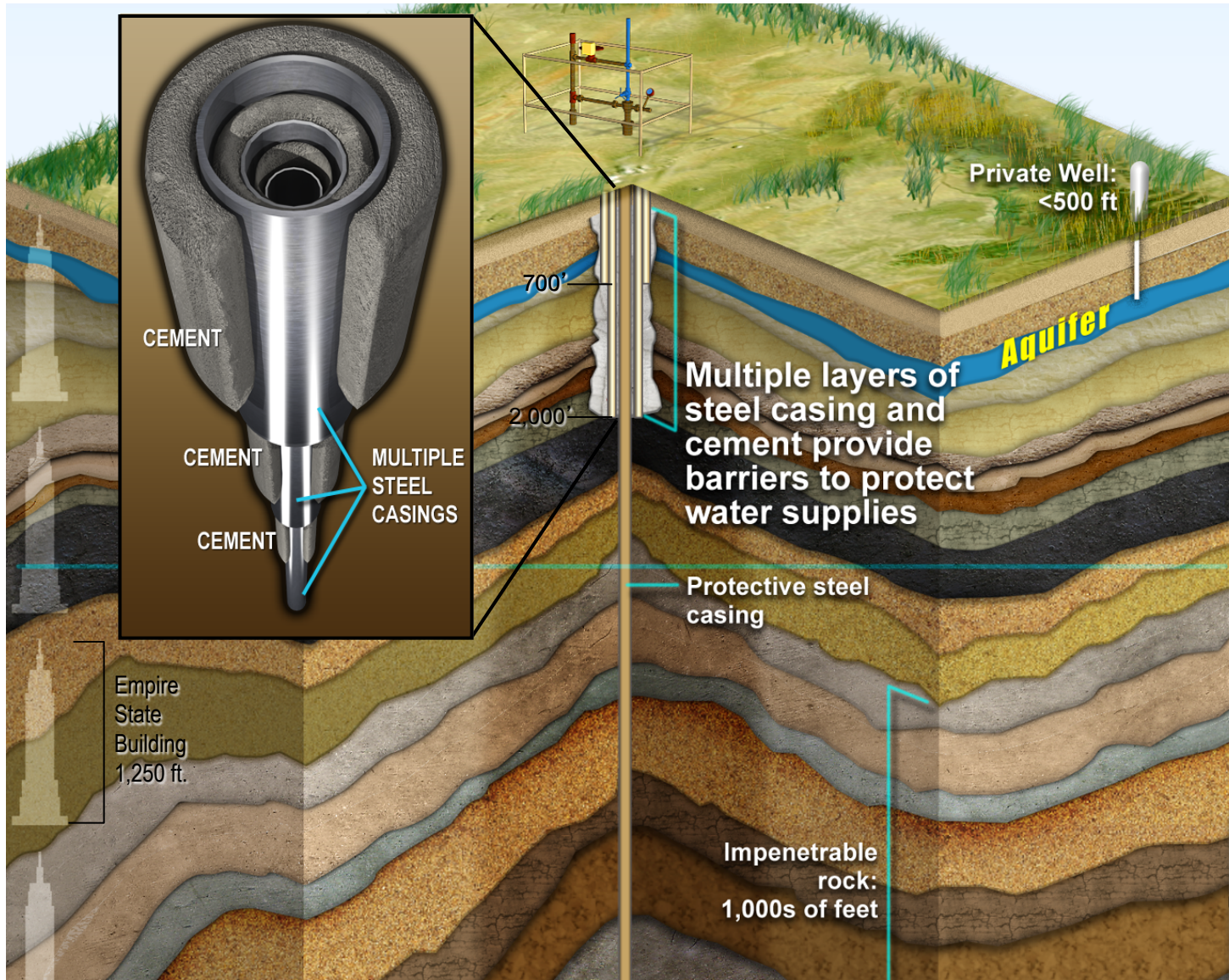
Captures cuttings and stores them in a lined reserve pit.

Closed Loop System



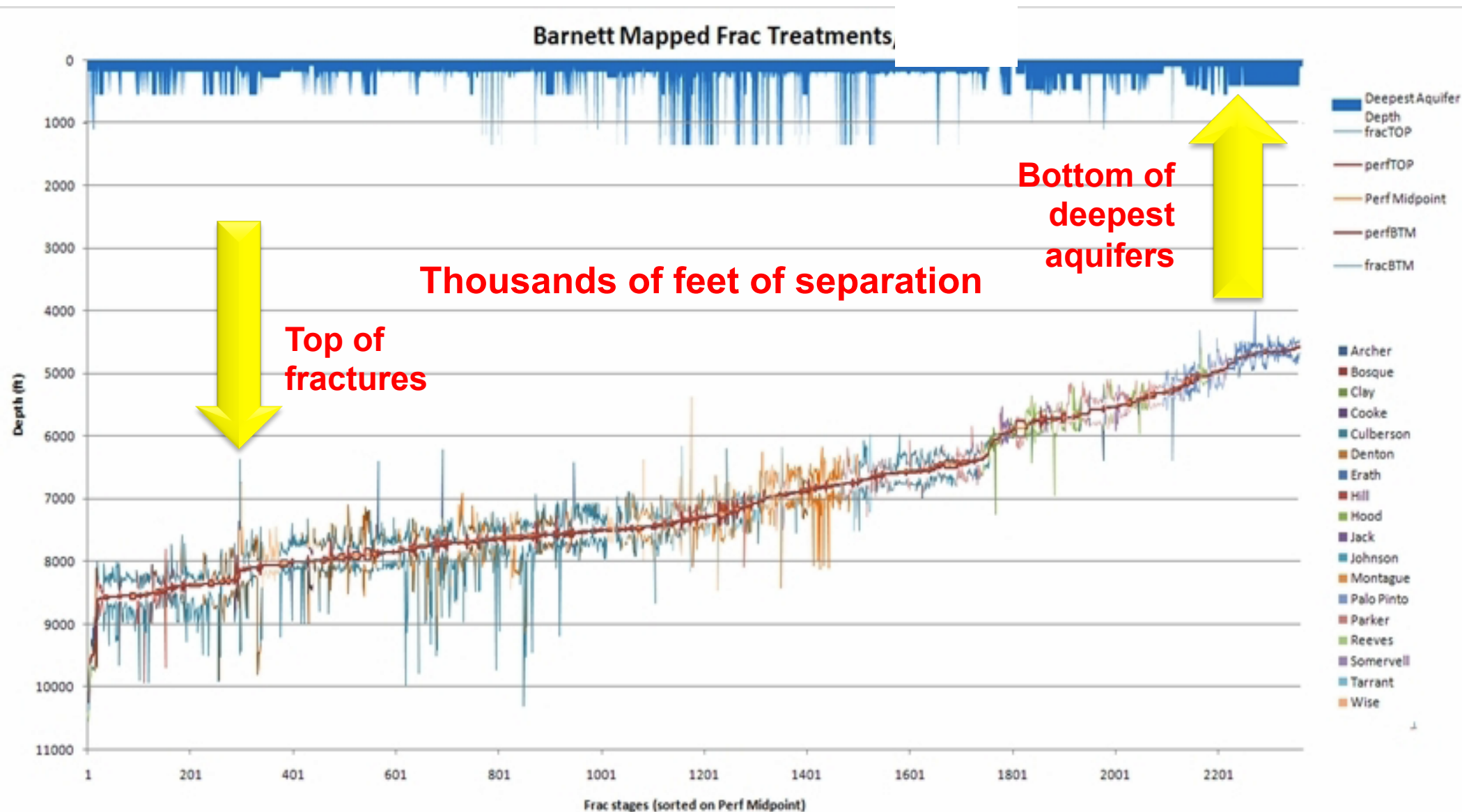
Captures cuttings without the need for a reserve pit. The contained cuttings can be recycled or safely transported to an approved landfill.

Groundwater Protection



Protection of surface water aquifers is achieved by running two strings of pipe and cementing across the water located above 700'

Technology Improves Understanding of Fracking Impacts



Fracture Height Determination – Microseismic

Key Recommendations: What is Needed

1. Support Prudent Development

- **Establish Regional Councils of Excellence to share effective environmental, health, and safety practices**
- **Adopt policies for more effective regulation of natural gas and oil production and operations**
- **Commit to and carry out community engagement**
- **Measure and reduce methane emissions**
- **By supporting prudent development, provide access to resources**

2. Better Reflect Environmental Impacts in Markets & Choices

- Develop and use tools to better analyze and compare the full environmental impacts of fuels and technologies**
- Consider options for internalizing the cost of carbon impacts into fuel prices**
- Keep open technology options for reducing GHG emissions from gas in the long run**

3. Enhance the Efficient Use of Energy

- **Encourage mechanisms to support greater adoption of energy efficiency in buildings and appliances**
- **Remove barriers to utilities' promotion of efficiency and combined heat and power**

4. Enhance the Regulation of Markets

- **Allow utilities to effectively manage their natural gas price risk**
- **Harmonize interactions between natural gas and power markets**
- **Provide greater certainty in environmental regulations affecting the power sector**

5. Support Needed Talent and Know-How

- **Support intellectual capital and a skilled workforce:**
 - Increase the Number of Qualified Natural Gas and Oil Professionals

Summary

- **We have enormous oil and gas resources – of potential value and importance to the nation.**
- **There's enough supply to support national objectives – including our economic, environmental and security interests.**
- **The lynchpin to realizing these benefits is prudent development – We have to do this right.**
- **And our recommendations help us move toward these outcomes.**

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