Perspective on Energy Business Challenges In the "Age of Energy Supply Anxiety"

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E&P Landscape

"Age of Energy Supply Anxiety"

- Demand + supply constraints + uncertainties = high prices
  - Global scramble to control oil & gas resources
- Soaring costs
  - Shortages of equipment, services & trained personnel
  - Technology imperative – improve recoveries & efficiencies spanning supply chain
- Changing competitive landscape - "resource nationalism"
  - Increasing state control of resources
  - Heightened geopolitical risks
- Growing conflict between "Energy Security" and "Environment / Climate Change" policies

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Energy Policy Challenges

- Energy Security

  Supply energy to fuel global economic growth
  - High economic growth rates
    - OECD = 2.5%
    - Non-OECD = 5.3%
  - Expanding middle classes – India, China = expanding demand
  - Integration of global economies
- Environment / Climate Change

  Manage consequences of energy use
  - Mitigate local and regional environmental impacts
  - Manage global carbon build-up in the atmosphere

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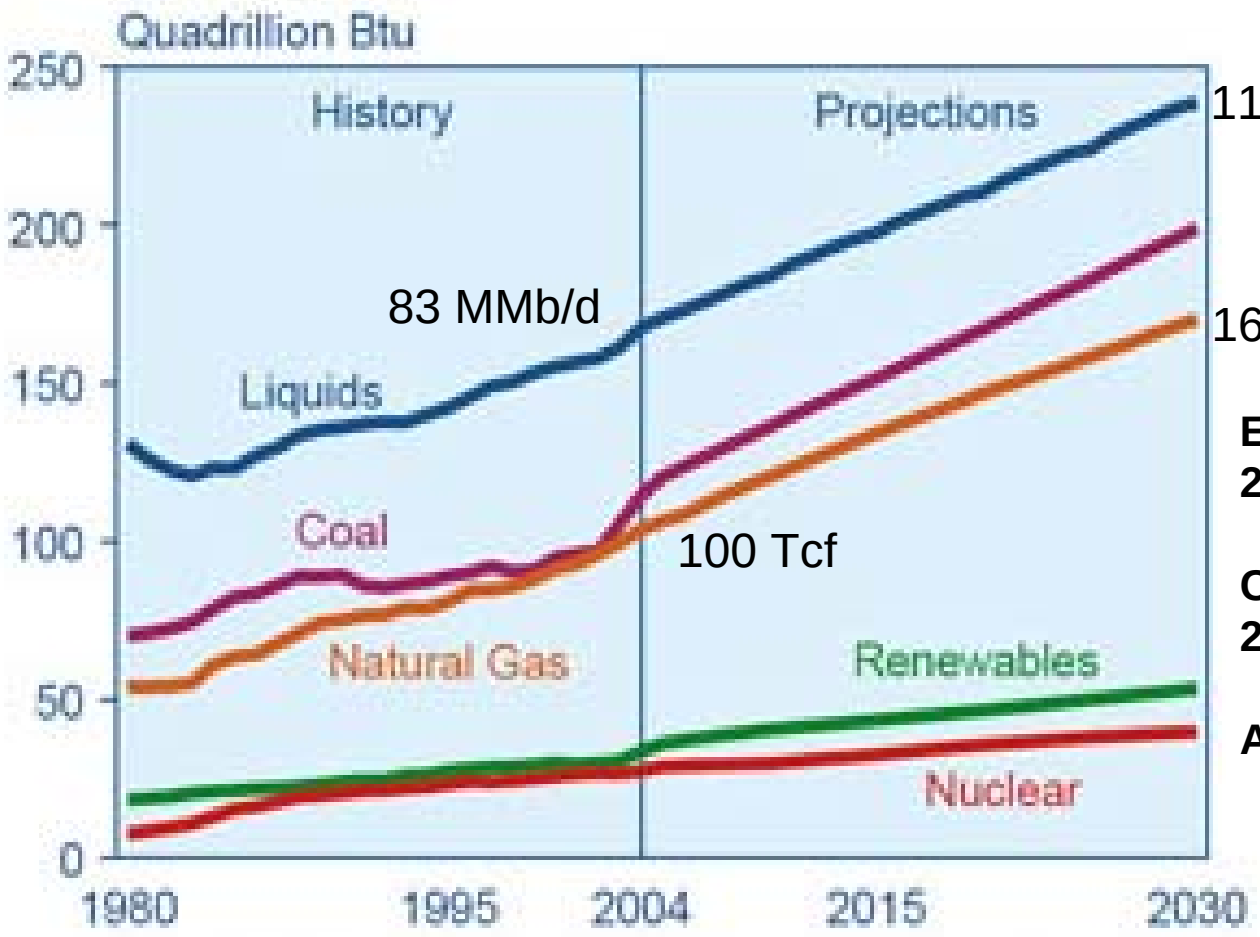
Energy Demand Challenges
Global Sources for Energy Supplies



118 MMb/d

163 Tcf

EIA energy growth:
2004 – 2030 = 57%

CERA "Dawn of New Age"
2004 – 2030 = 75%

Asia = 50% oil demand
75% power demand

Source: EIA International Energy Outlook 2007

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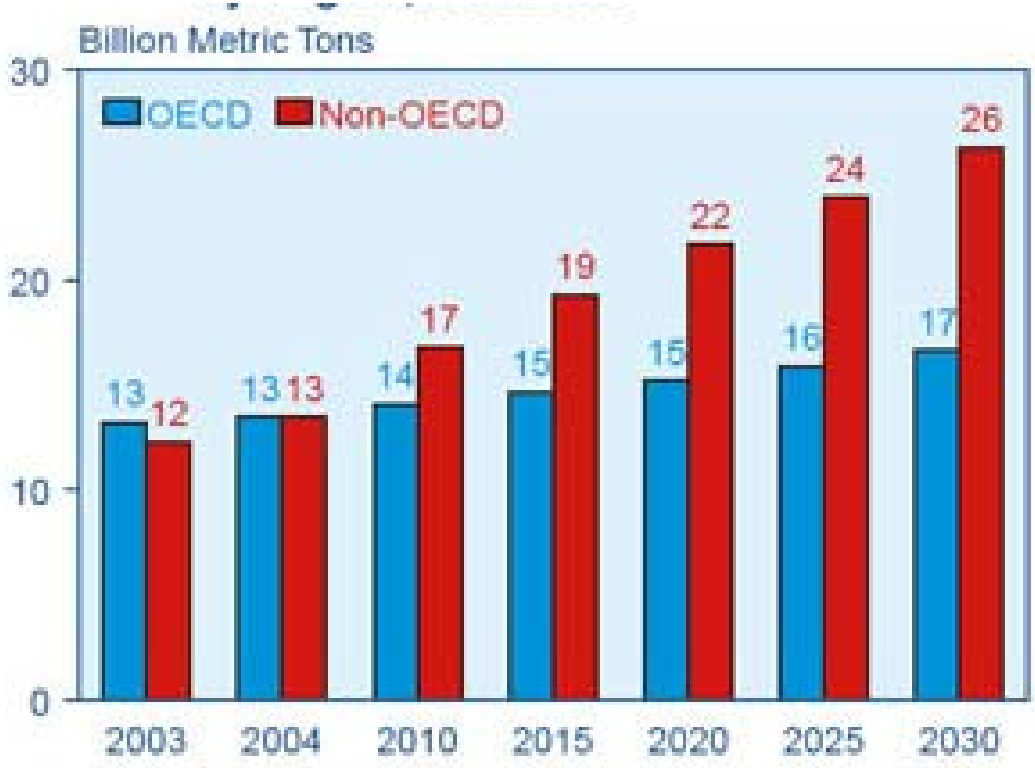
Energy Industry Challenges
Managing Global CO2 Emissions



Solutions

- **Energy efficiencies**
- **R&D – innovative technologies and commercialization:**
- **Carbon capture & storage**

Source: EIA International Energy Outlook 2007

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Objectives

- Outline challenges to transform global O&G resources to supplies
- Frame US energy vs climate issues
- Outline impacts of challenges on industry business practices and technologies

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Challenges in Transforming Oil & Gas Resources to Supplies

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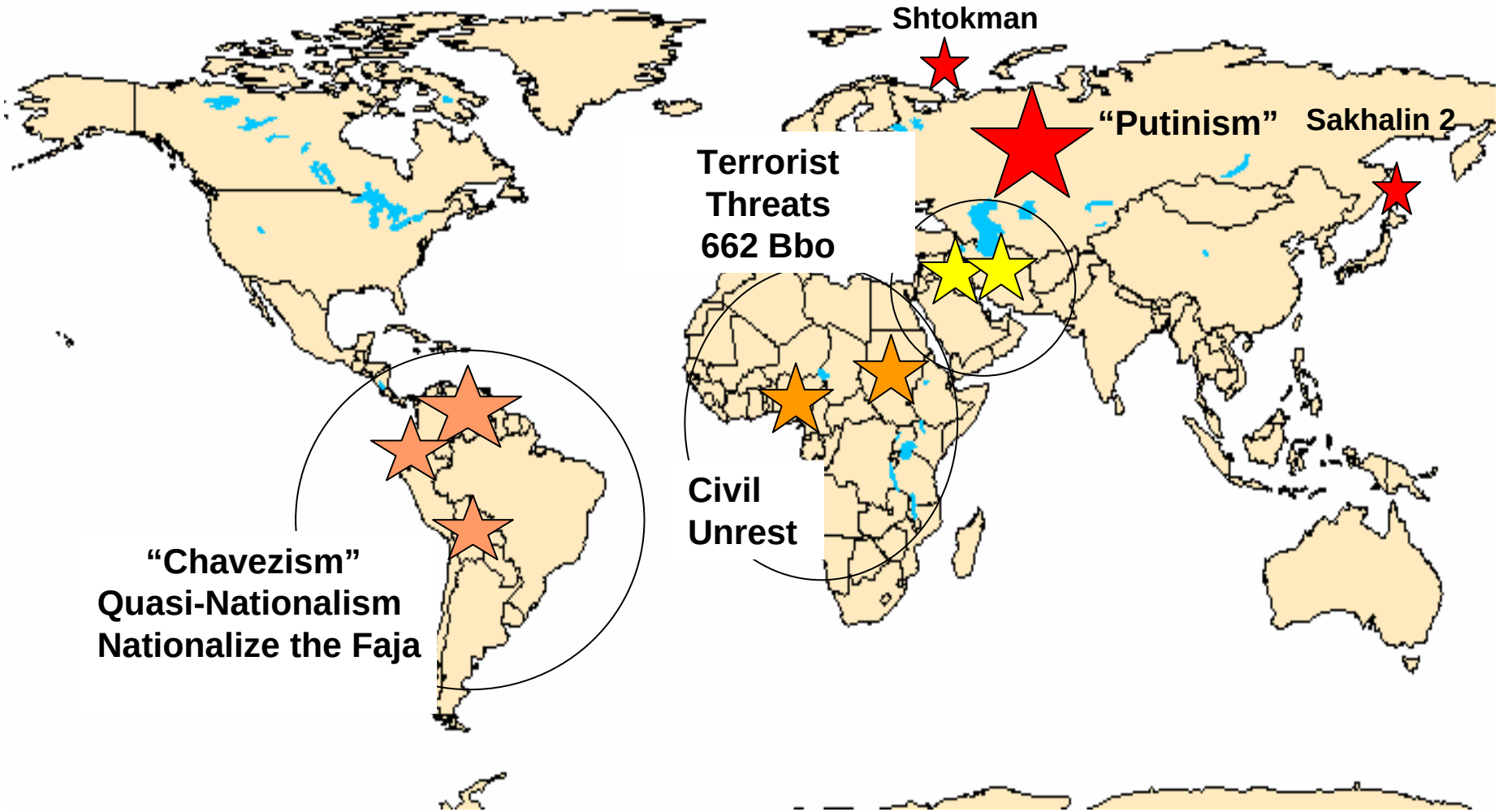
Challenge #1:
Elevated Political Risks & Uncertainties



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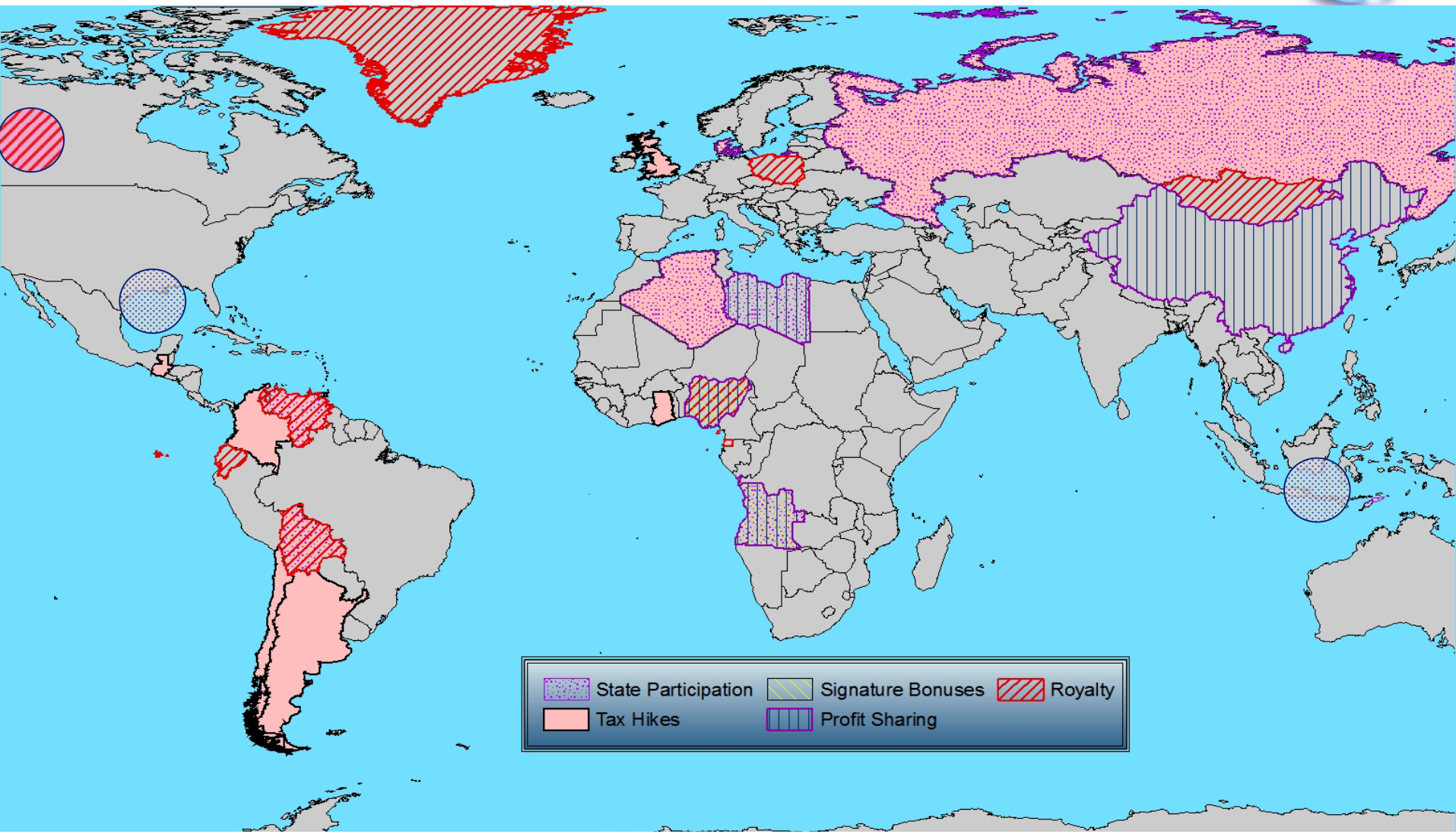
Challenge # 2: Increasing State Control: Escalating Fiscal Terms



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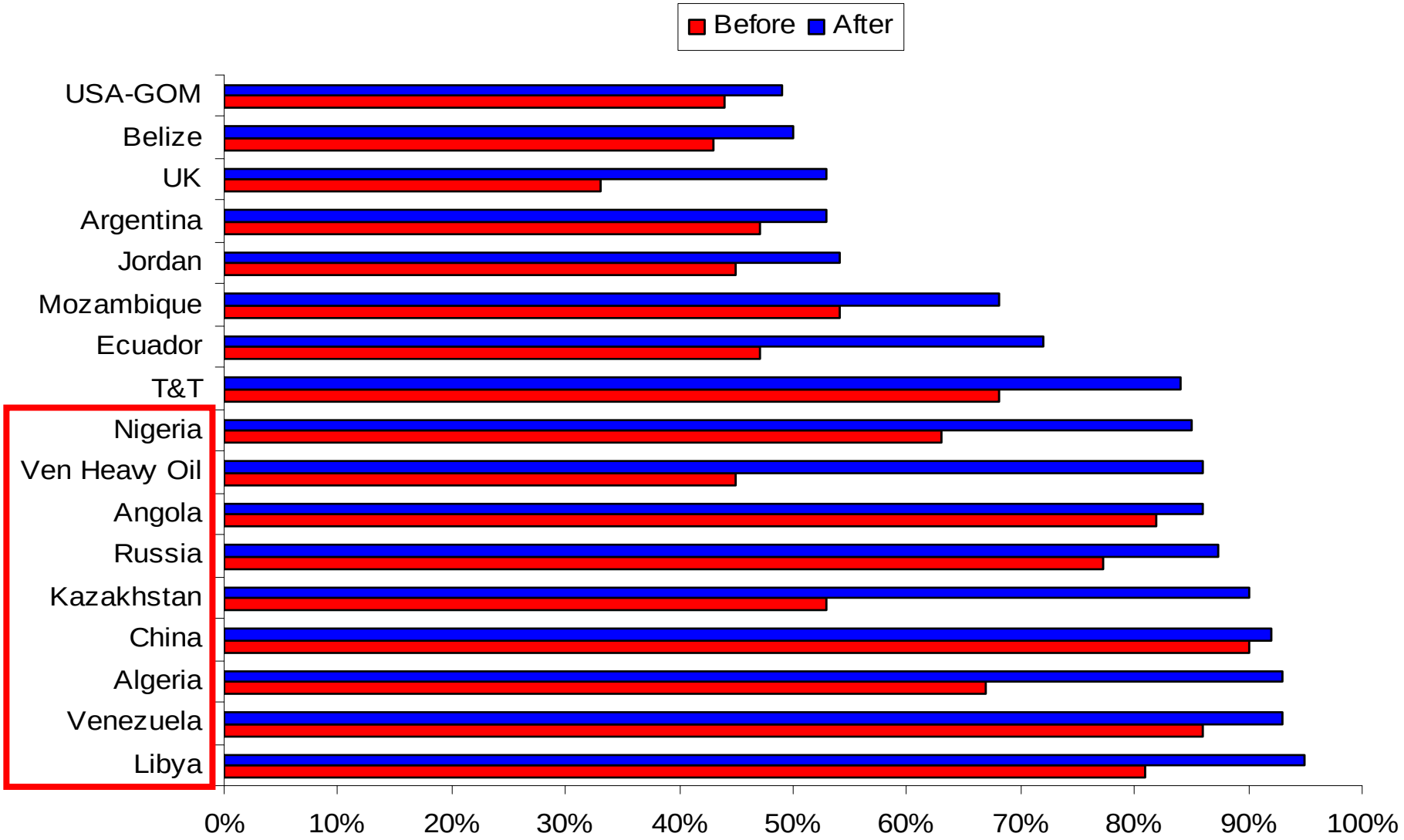
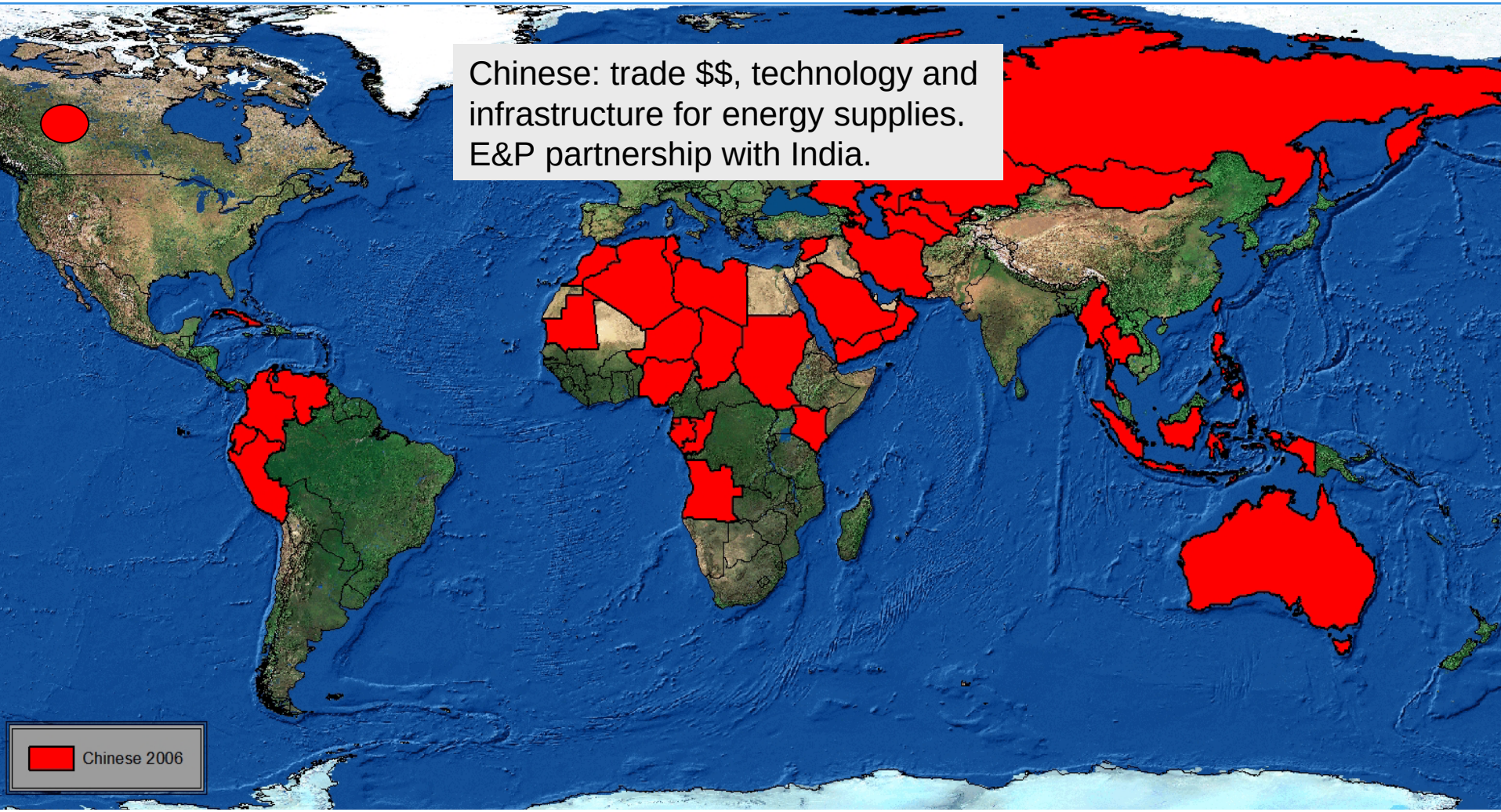
Challenge #2 Increasing State control Escalating Fiscal Terms (2002-2007)



Challenge #2: Increasing State Control International NOC Expansion – Chinese



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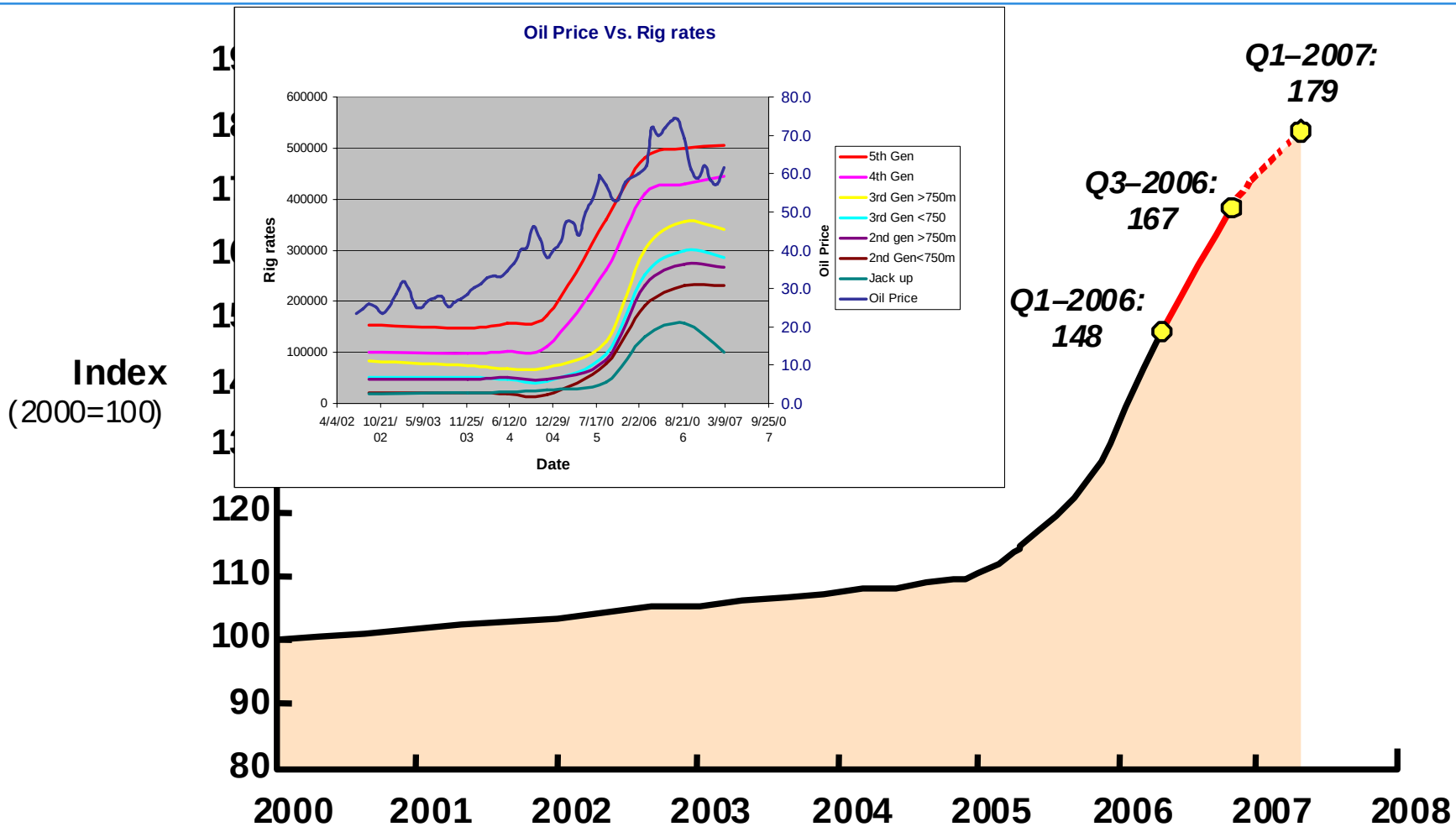
Challenge #3 - Soaring Costs

Shortages of Materials & Personnel

IHS/CERA Upstream Capital Cost Index (UCCI)



Source: Cambridge Energy Research Associates

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Challenge #4
Environmental Regulations & Climate Change Policies

Representative John Dingell (Chmn. House Energy Committee)

"The issue of global climate change and its effect on our national energy policies is critical."

Action: Propose to reverse most of the energy development incentives in the 2005 Energy Bill.

"Properly addressing climate change requires us to address the issue of consumption. We do that by making consumption more expensive."

Action: Propose carbon taxes, gasoline taxes and eliminate mortgage deduction on large homes.

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Challenge #5 Reserve Replacement

"Three pillars for future liquids resources"

1. Field growth
2. Unconventional resources
3. Yet to find

"Building Blocks to Estimate O&G Resources"

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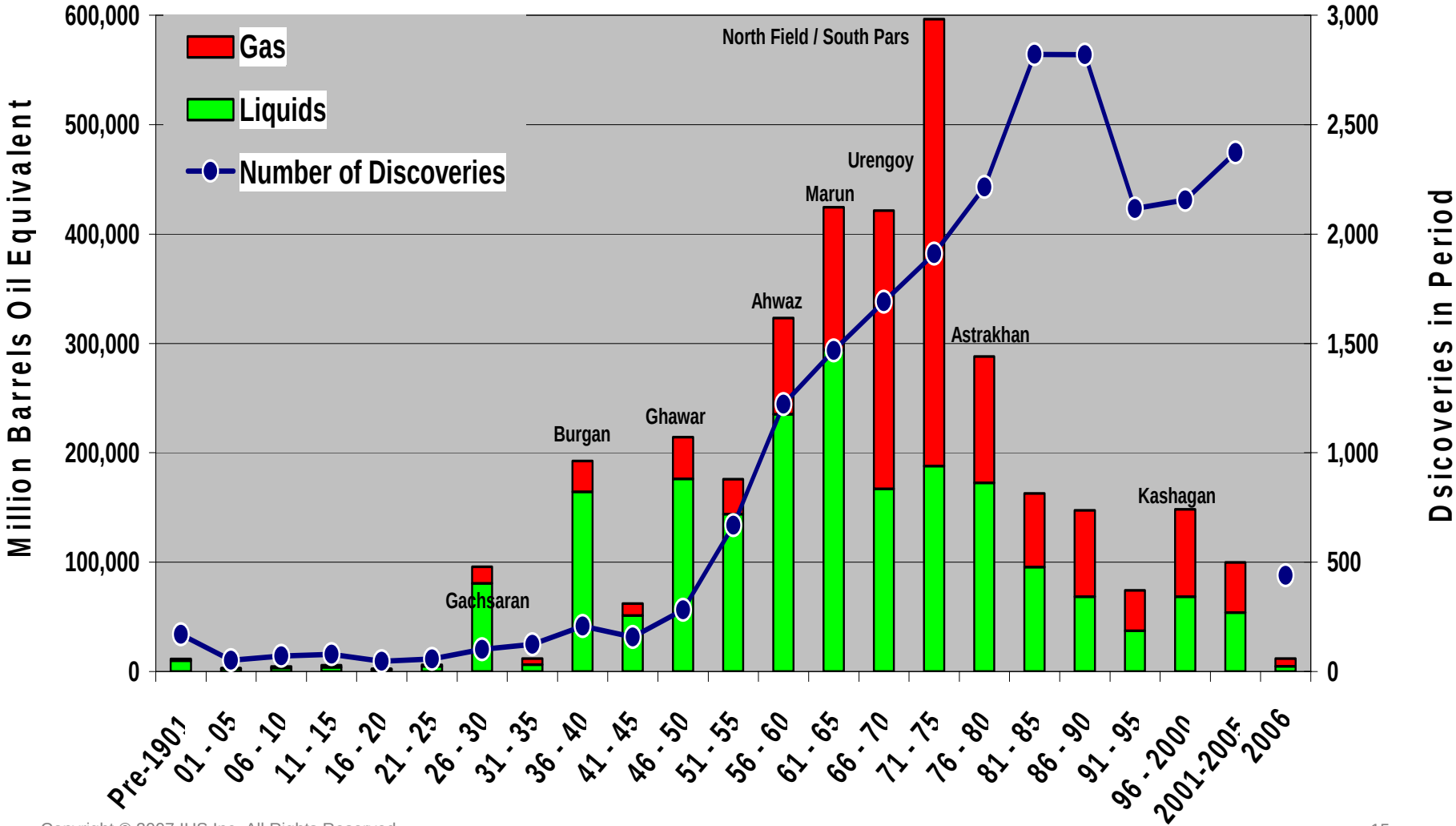
Challenge # 5 Resources Replacement
Resources & Discoveries 1900-2006



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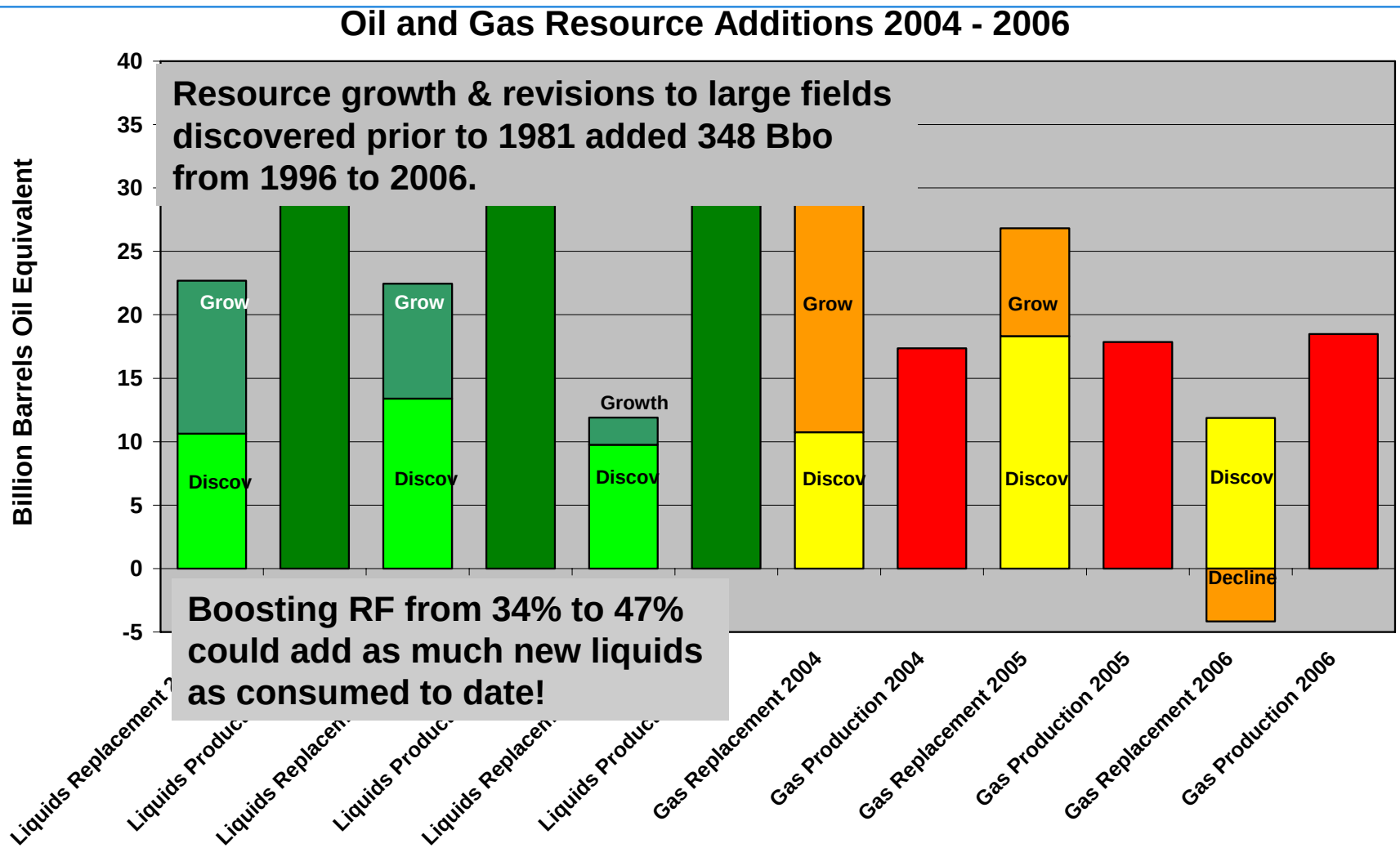
Discoveries & Field Growth 2004-2006



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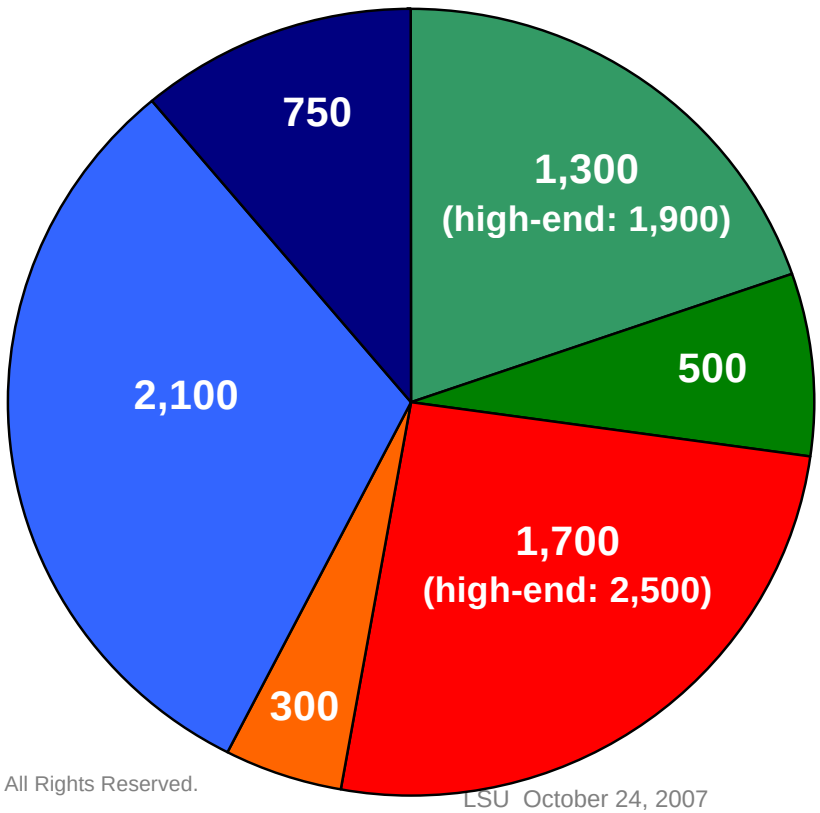
Challenge # 5: Reserves Replacement
Unconventional Liquids Resource Plays

Distribution of Initial *In-Place* Resources of Major Non-Conventional Sources of Liquid Hydrocarbons (billion barrels)



***In-place* resources are three times greater than the 2,330 billion barrels of *recoverable* resources of conventional oil discovered to date.**

- Venezuela Orinoco Oil Belt
- Other Extra-Heavy Oil
- Canada Oil Sands
- Other Bitumen
- USA Shale Oil
- Other Shale Oil

Figure 1

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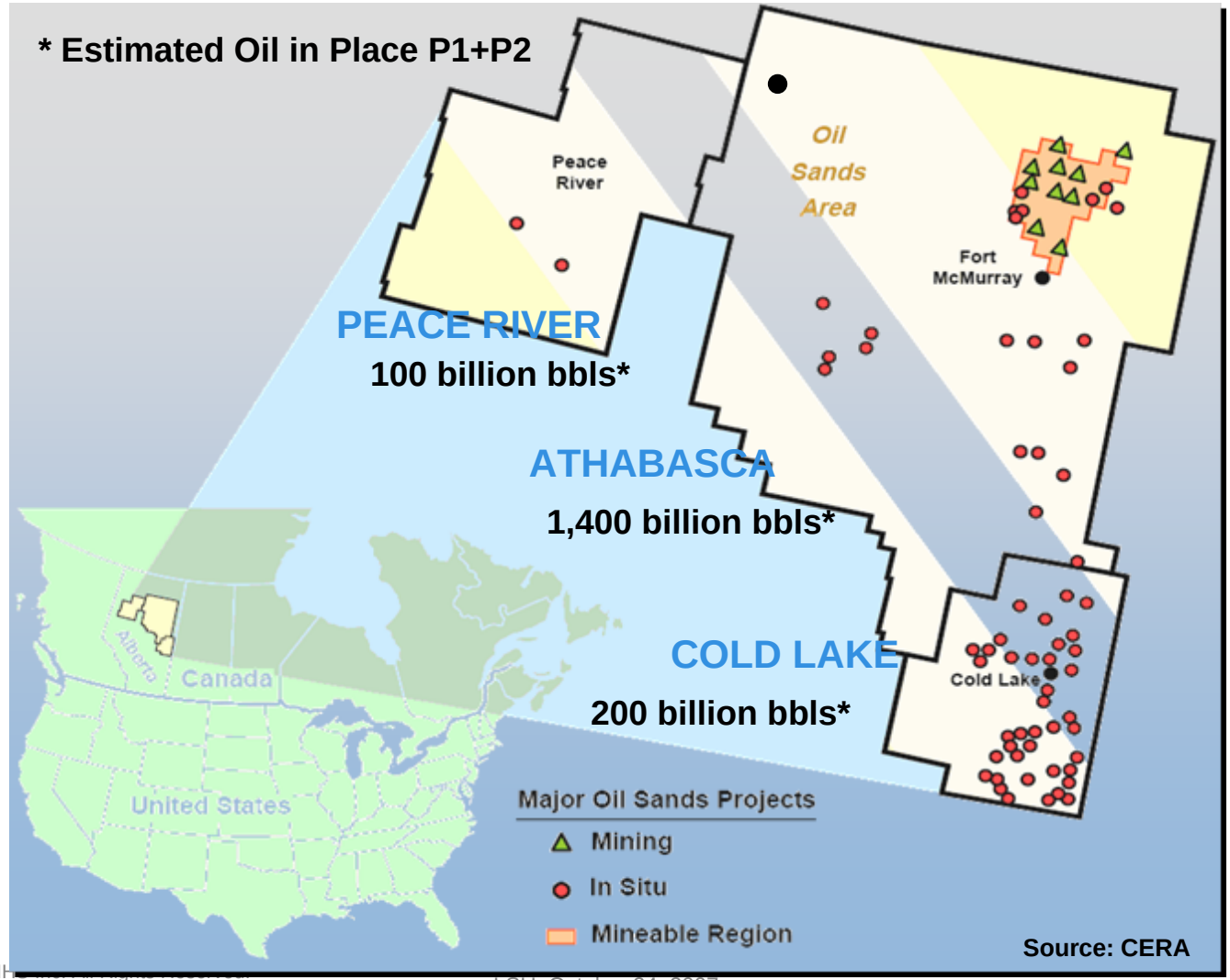
Canadian Oil Sands Map



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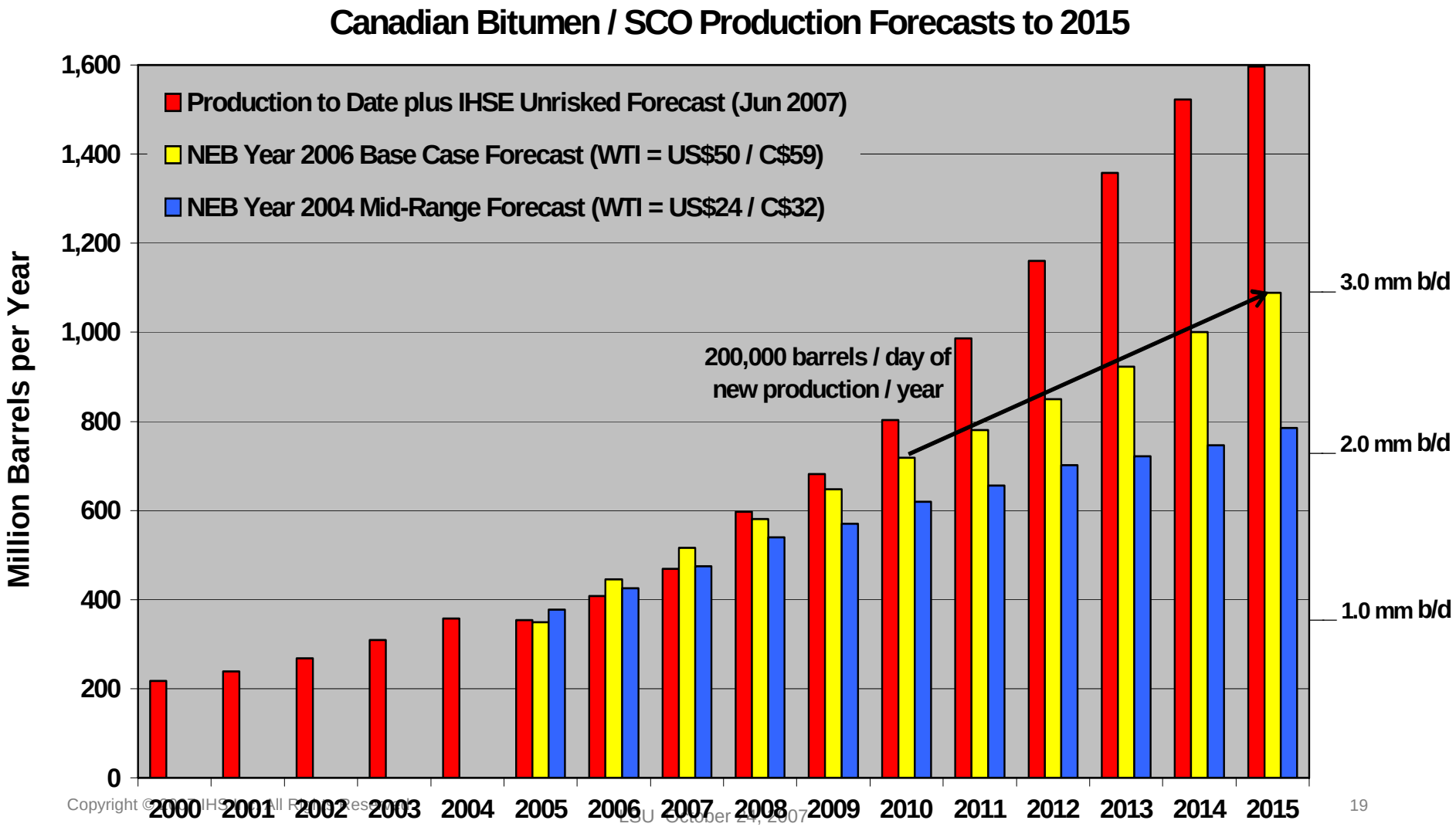
Challenge # 5: Reserves Replacement
Unconventional: Canada Oil Sands - Bitumen - Production



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Canadian Oil Sand Projects
Capital Cost Creep

Project	Operator	Start up	Orig Cost $ Billion	Current Est Increase
Millennium	Suncor	2002	$3.5	70%
Albian	Shell	2003	$5.7	60 %
Phase 3	Syncrude	2006	$8.6	100%
AOSP Expan 1	Shell	2010	$11.0	60 %
Long Lake	OPTI-Nexen	2007	$4.6	25 %
Horizon	CNRL	2008	$7.6	12 %

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Canadian Oil Sands
Operational Efficiencies- Thermal

Energy Users	2000	2007
Recovery Factors	13 %	40%/80%
Water usage	3-4bl/bl bitumen	1/4bl/bl bitumen
Gas usage	0.6 Mcf/bl	0. 47 Mcf/bl
Steam: oil ratio	4.0- 3.5	3.5 - 2
Emissions		-45%/ 90% NG

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Canada
Above Ground Challenges

- Nexen Long Lake heavy oil project delayed. Capital costs increase 15% from initial $5.3 Billion. Extreme skilled labor shortages to complete production and upgrading infrastructure.
- Canadian Royalty Review Board:
  - Months of uncertainly awaiting proposed tax and regulatory revisions for greenhouse gasses.
  - Canada 2007 drilling down 35% from 2006.
  - GHG emission problem: (Kyoto)
    - Pledged 6% reduction from 1990 by 2012
    - Current 27% increase from 1990
    - Propose 18% reduction from 2006 base by 2010; 2% annual thereafter
    - Oil sands reduce emissions per barrel by 42 % since 1990 but increased production by 4X
  - CNR to cancel 425,000 b/d oil sands development and reduce gas drilling 65% if proposed tax increases are implemented

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U.S. Natural Gas

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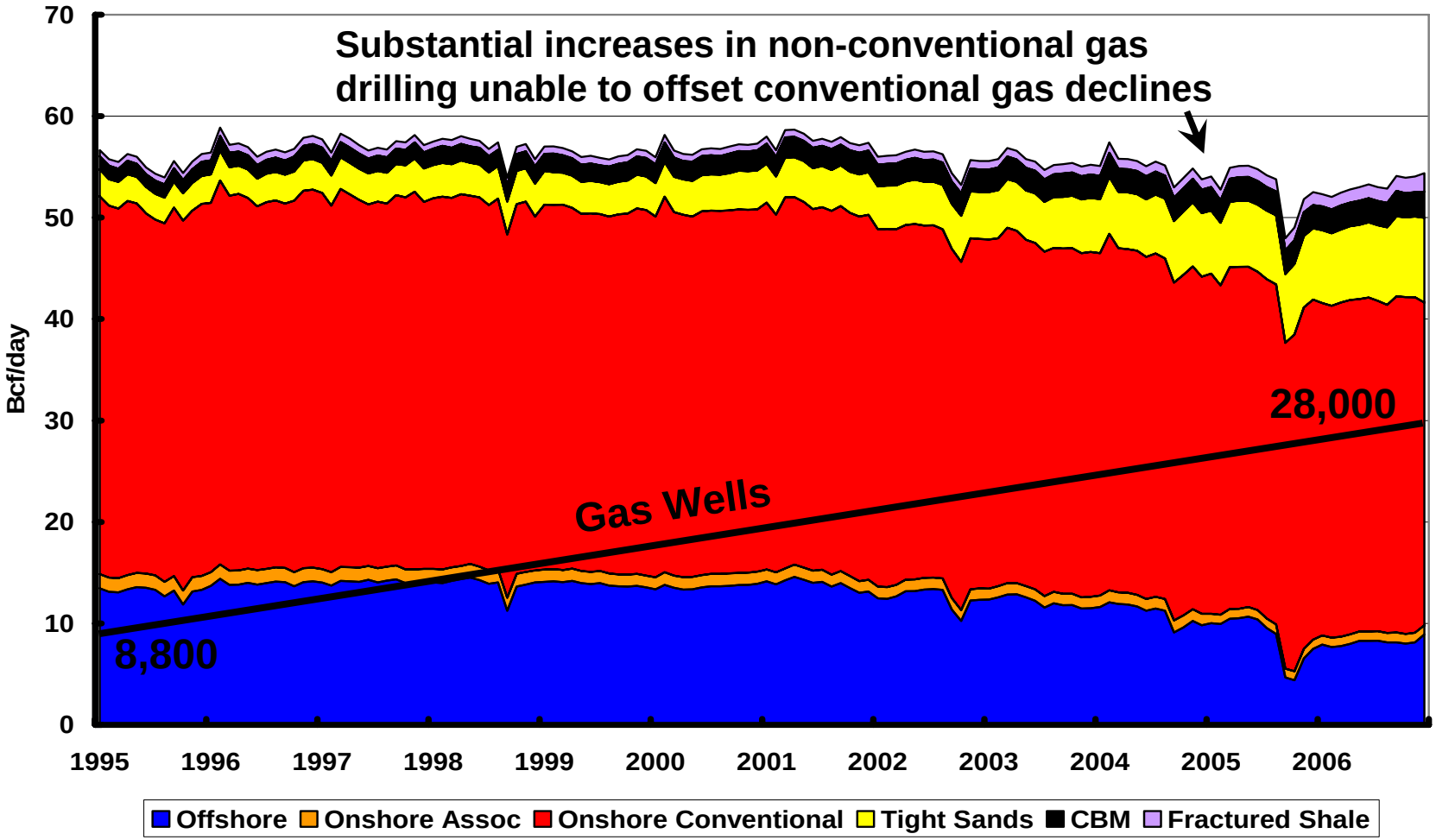
U.S. Daily Gas Production by Source 1995-2006



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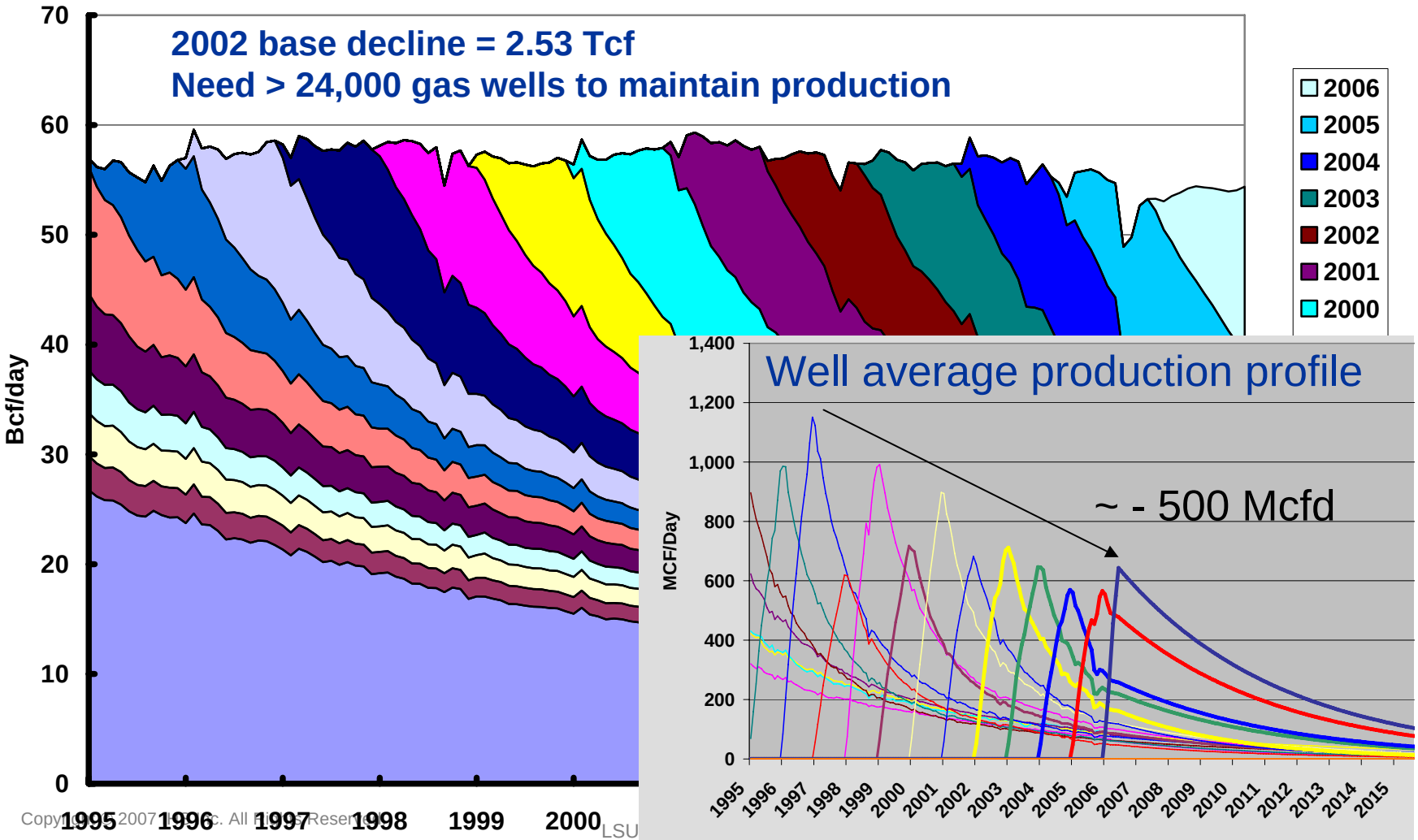
Vintage Gas Production Profile
U.S. Lower 48 States: 1995 - 2006



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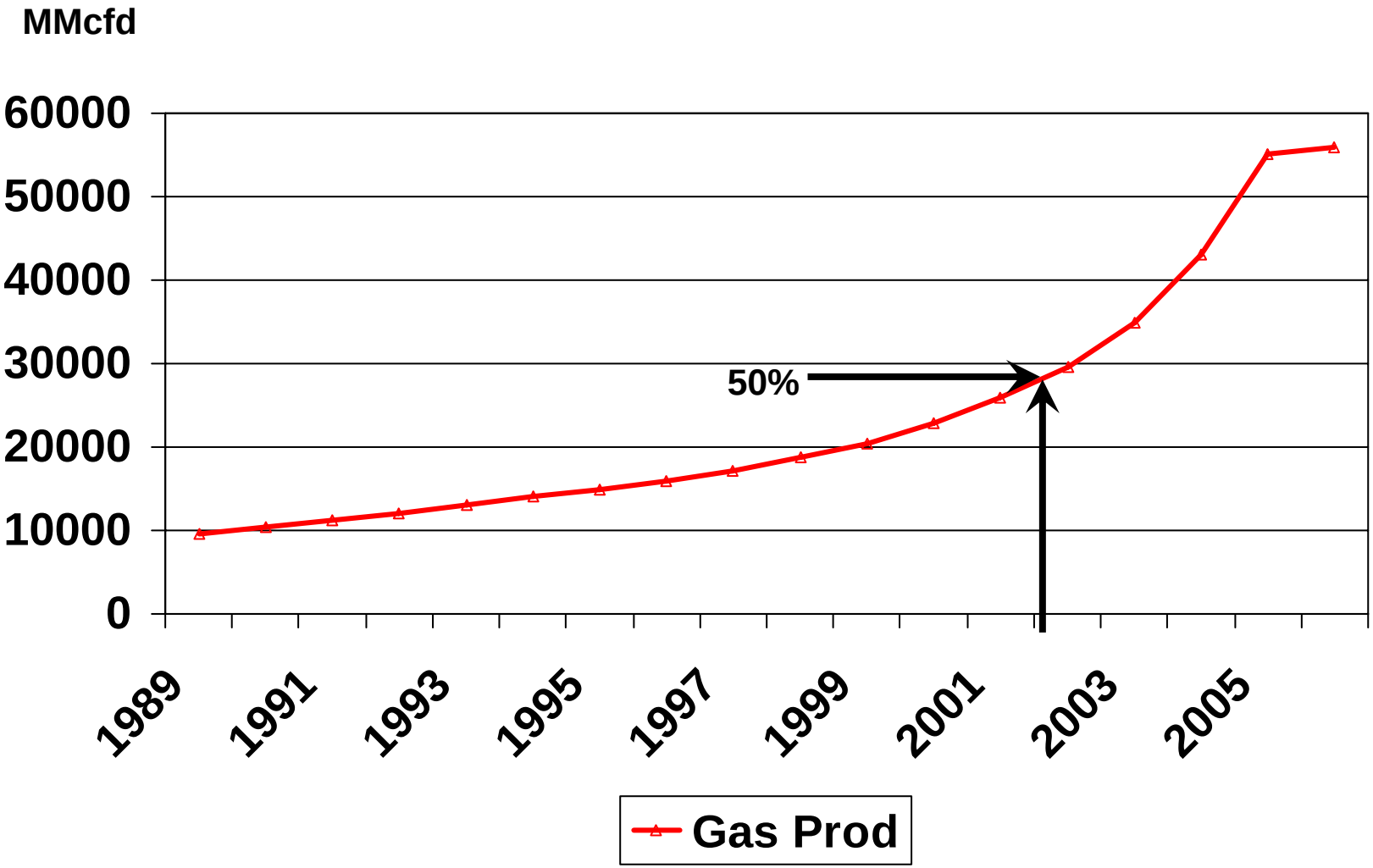
US Vintaged Daily Gas Production Contribution to January 2006 Volume



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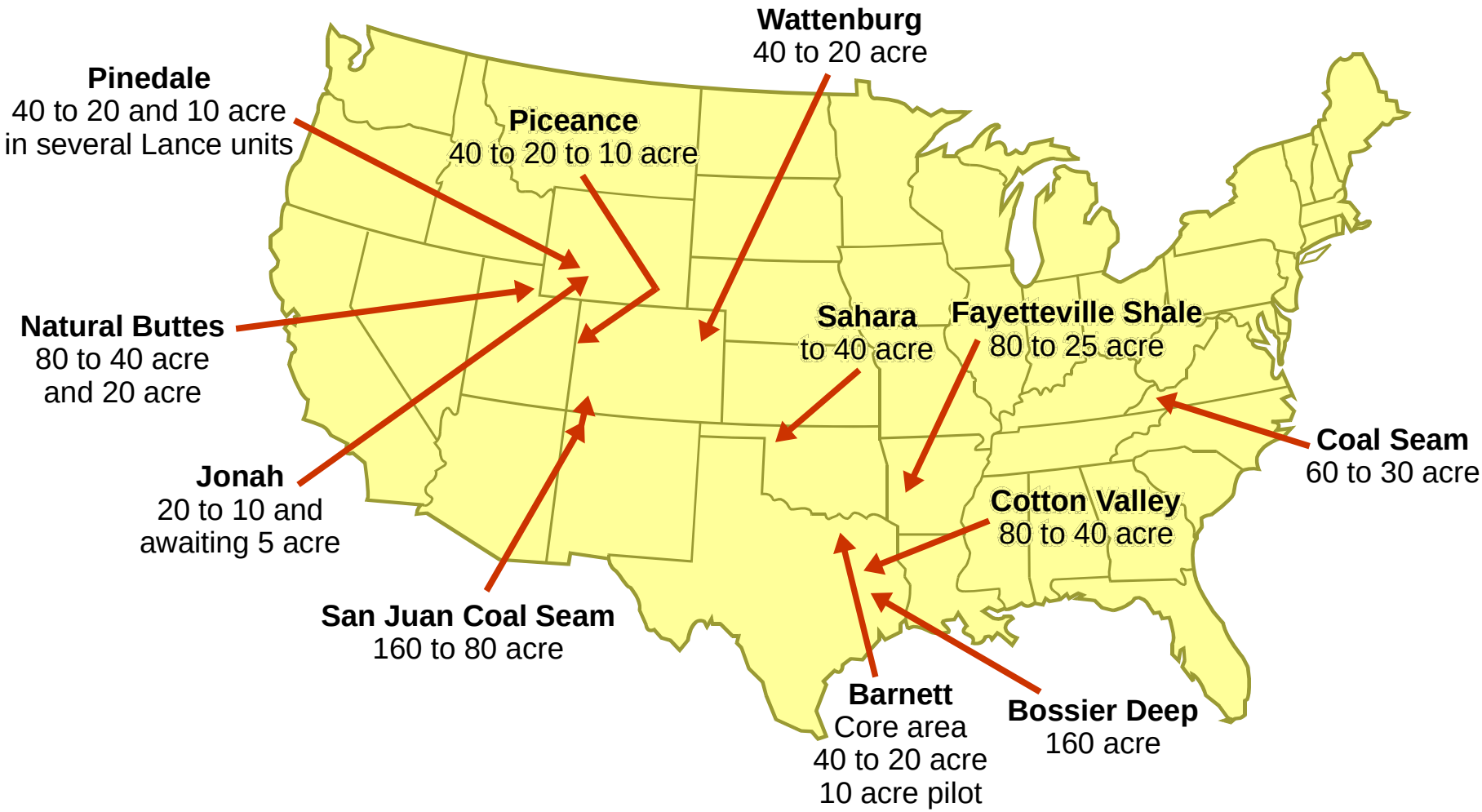
The Key to Unconventional Gas Growth: Increasing Well Density in Lower 48 Hotspots



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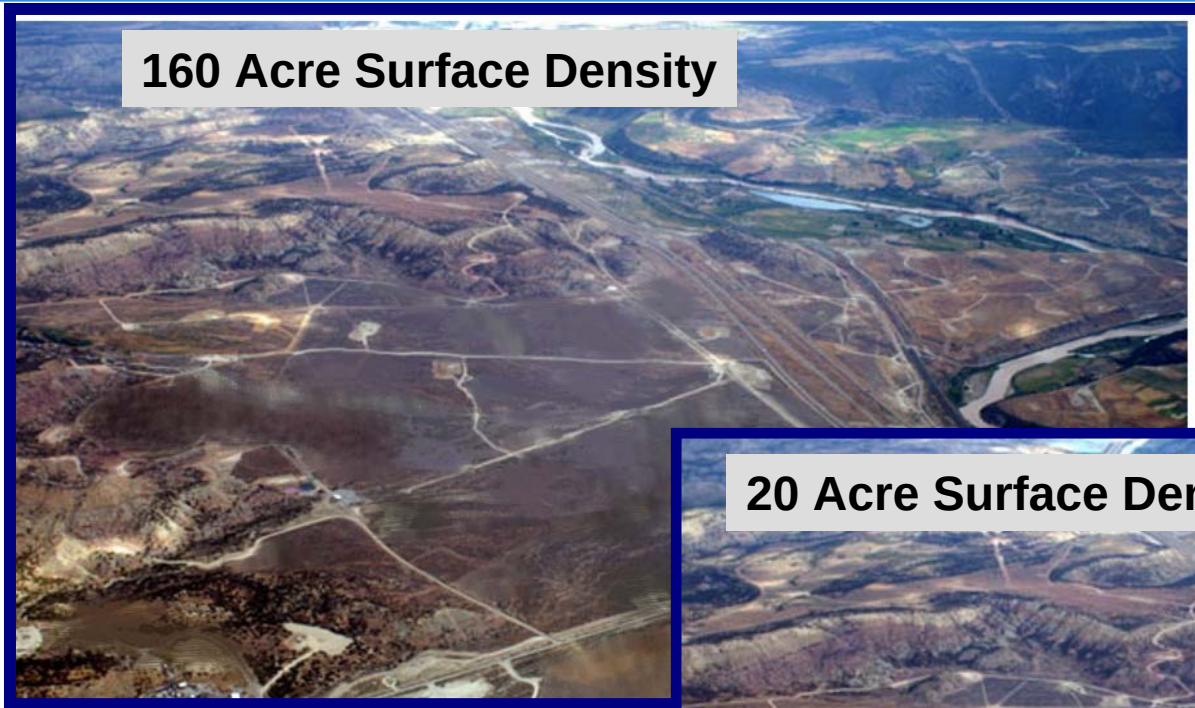
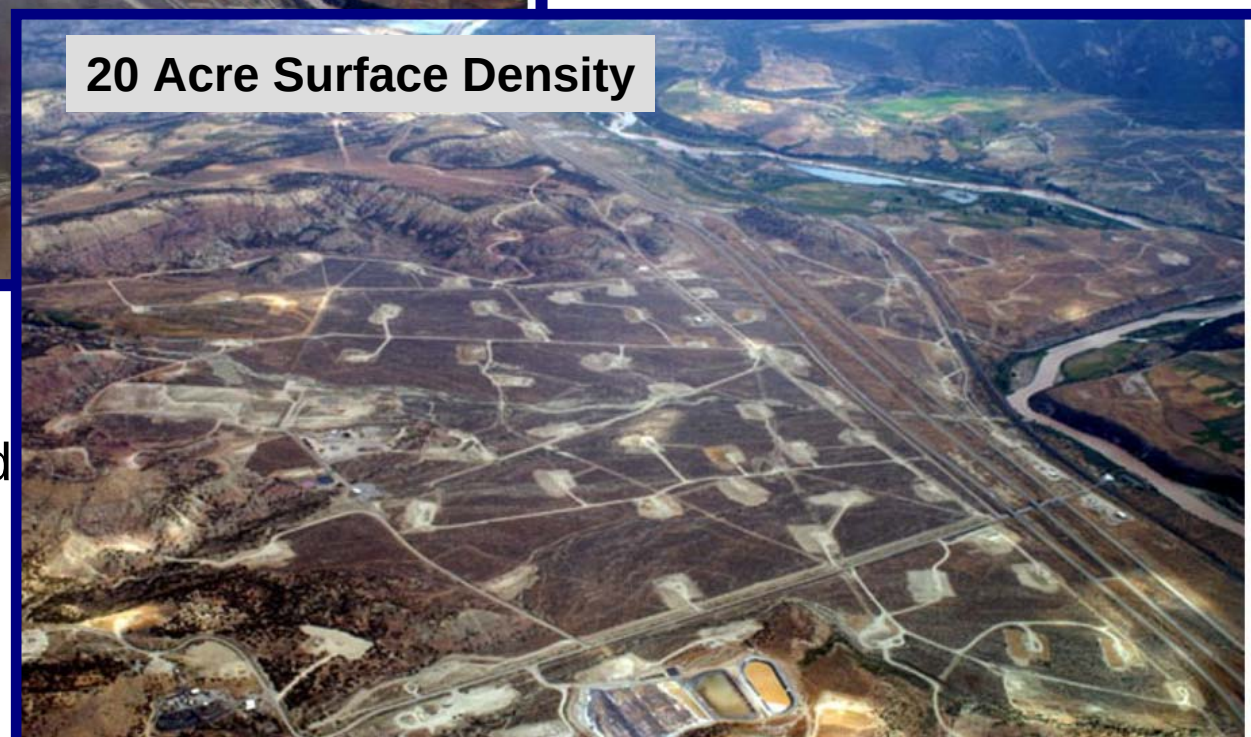
Source: Cambridge Energy Research Associates.
Updated May 2007.
40916-80

Tight Sand – Basin Centered Gas Plays
Increased Density & Surface Disturbance



Solutions:
- **Drill from pads**
- **Pipe water**
- **Seasonal activity**
- **Community relations**



Characteristics:
Porosity < 13%
Permeability 0.001-1.0 md
Recovery ~ 10 %

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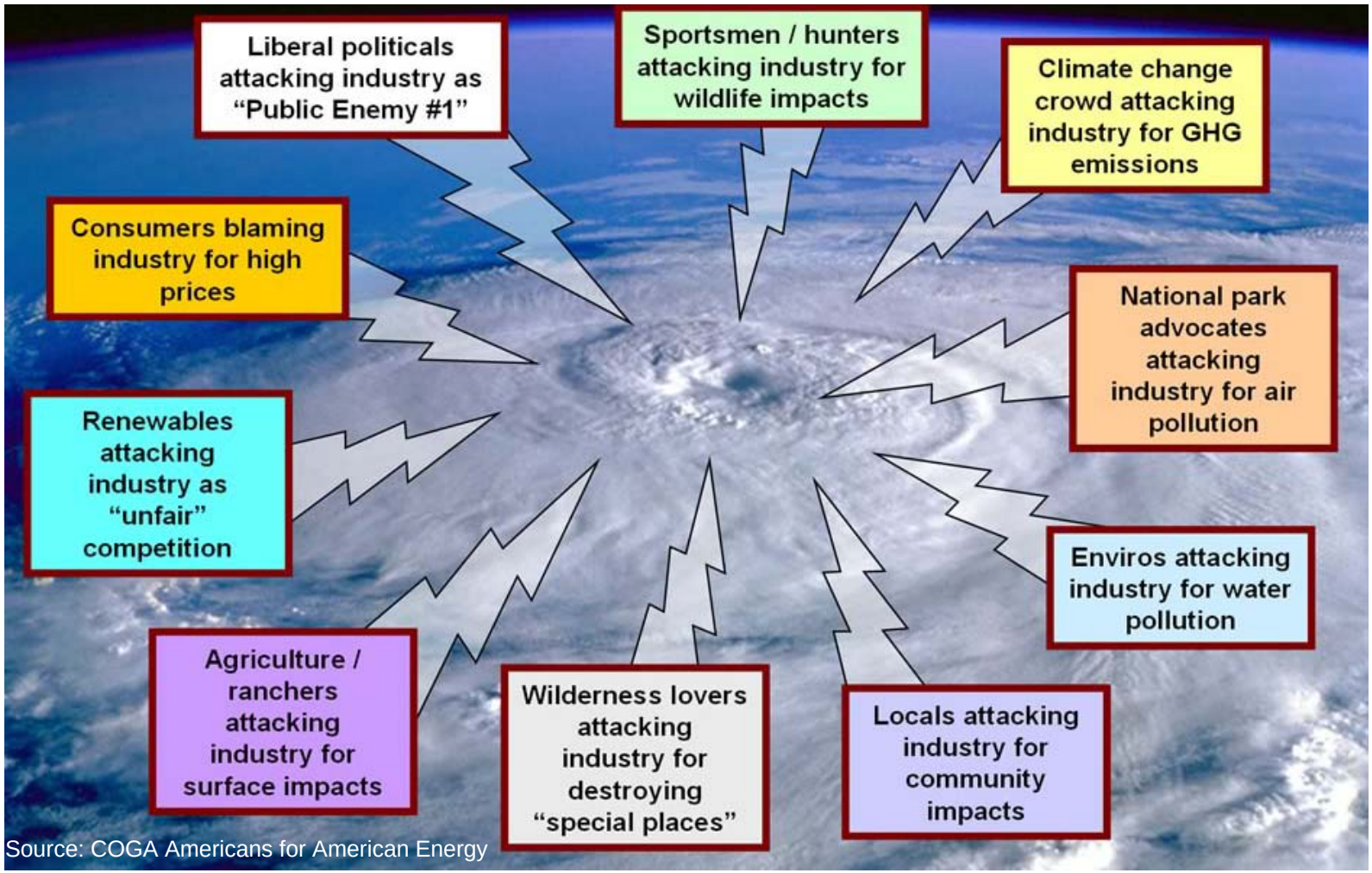
CDX GAS

Anti-Hydrocarbon Challenge
The Perfect Storm



Source: COGA Americans for American Energy

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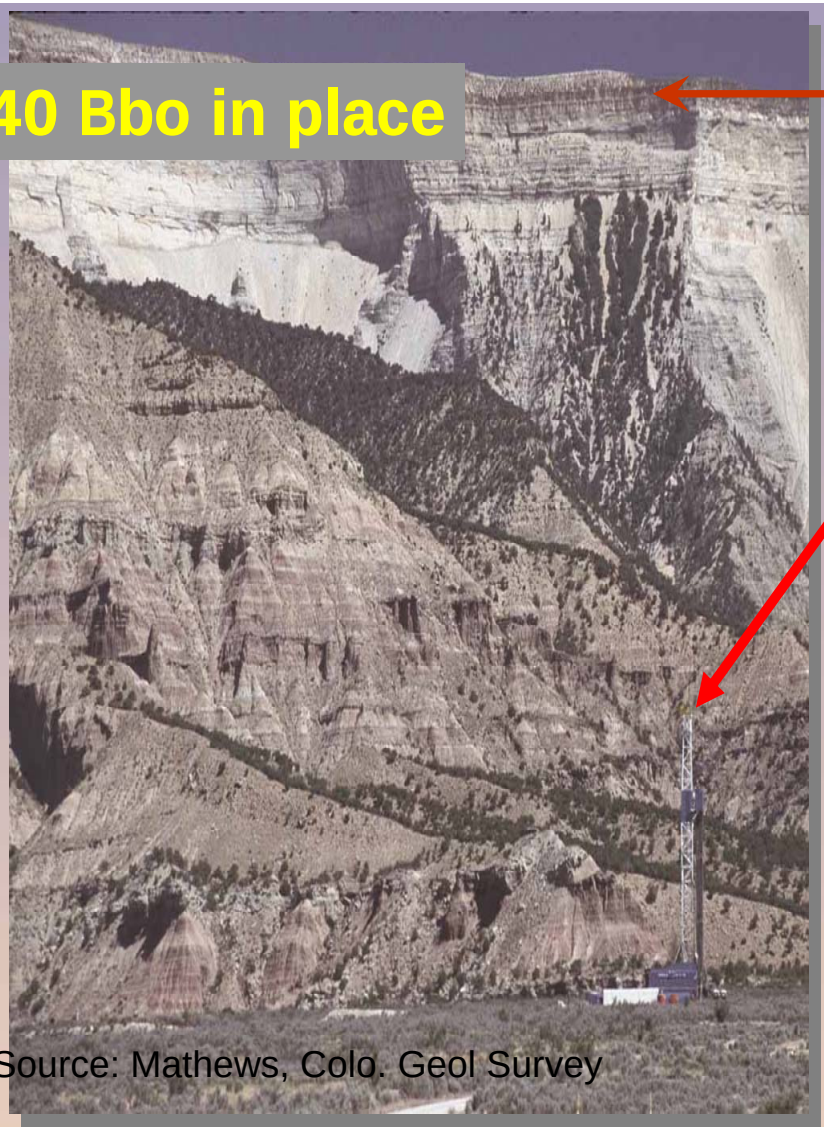
Energy Security vs Climate Security
Oil Shale Outcrop: Roan Cliffs, Rifle, Colorado



Source: Mathews, Colo. Geol Survey

The Mahogany Zone in the Roan Cliffs above Rifle, CO.

Colorado has all, or parts, of seven of the top 50 natural gas fields in the nation!

Four of the top 50 gas fields in the United States are located along I-70 below the Roan Cliffs

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Gas Development Issues
Roan Plateau, Colorado

- BLM approves strict development rules on 70% of the 73,602 acre Roan Resource Management Plan area.
- Limits drill activity to ridges; pads > ½ mile separation; maximum 250 acres (~ 0.6% of area) active at any time
- Reduces development of 6-7 Tcf of recoverable gas with potential 6 billion revenue to CO over 30 years.

Reactions:

- Senator Salazar: 120 day moratorium for CO to respond
- Gov. Ritter: Voiced deep reservations to drilling on the plateau
- Rep. Udall: Legislation to ban rigs from the plateau
- Rep. DeGette: Bill to designate Roan Plateau as Wilderness Area

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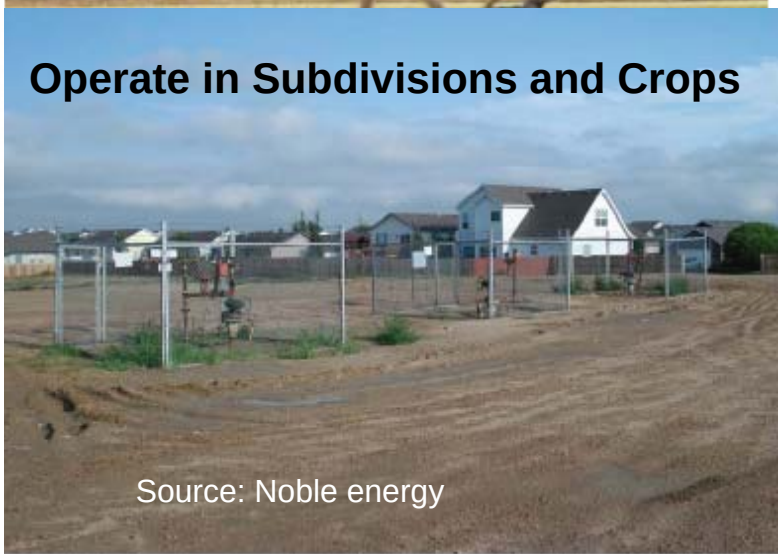
New Operating Practices
Fulfilling the Social – Environmental "License"



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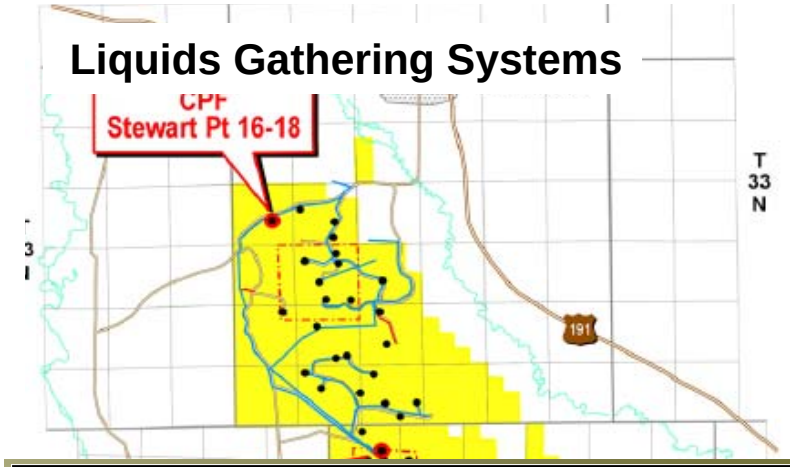
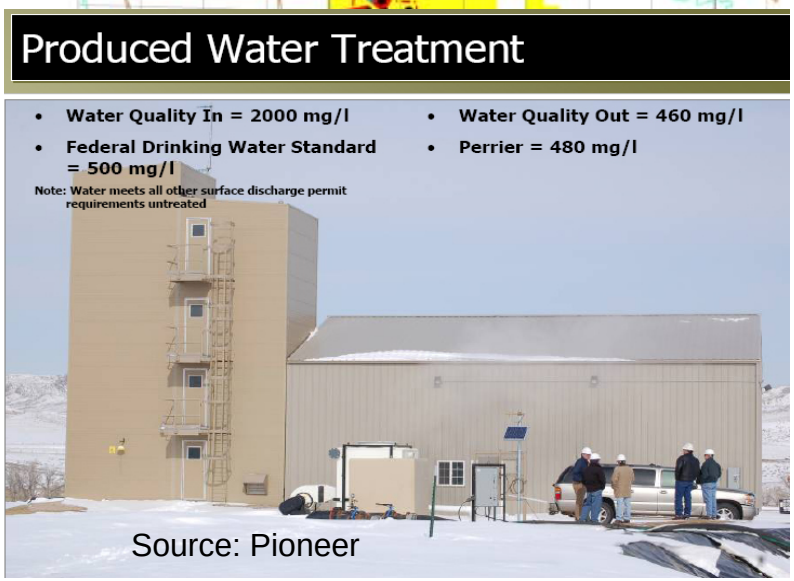
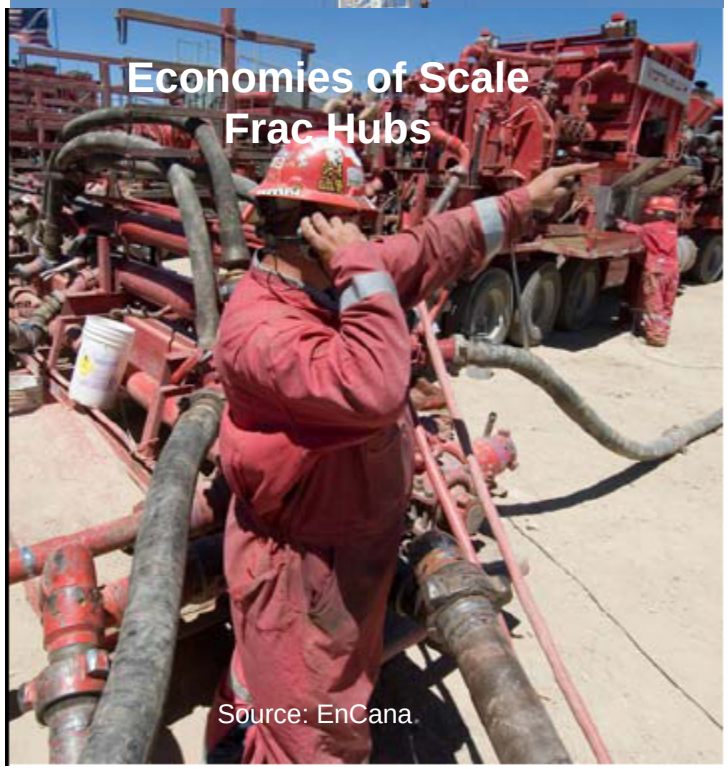
New Operating Practices
Efficiencies – Environment - Costs







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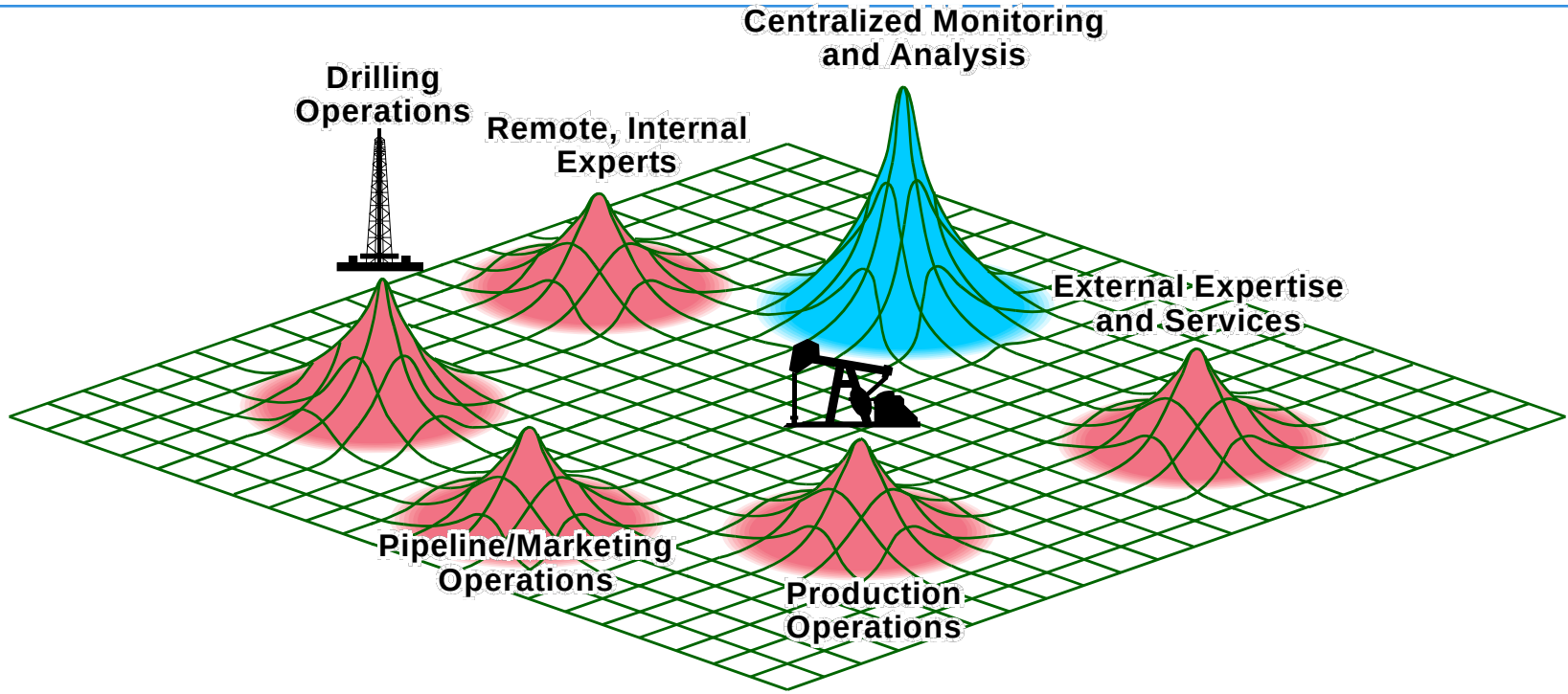
The Digital Oil Field of the Future (DOFF)



Integrated Field Planning

- Total asset awareness
- Right-time analysis & decision-making
- Timely execution

Remote Project Management

- People
- Process
- Technology

Results

- Increased reservoir recovery
- Increased production rates
  - Better well performance
  - Reduced downtime
- Lower operating costs

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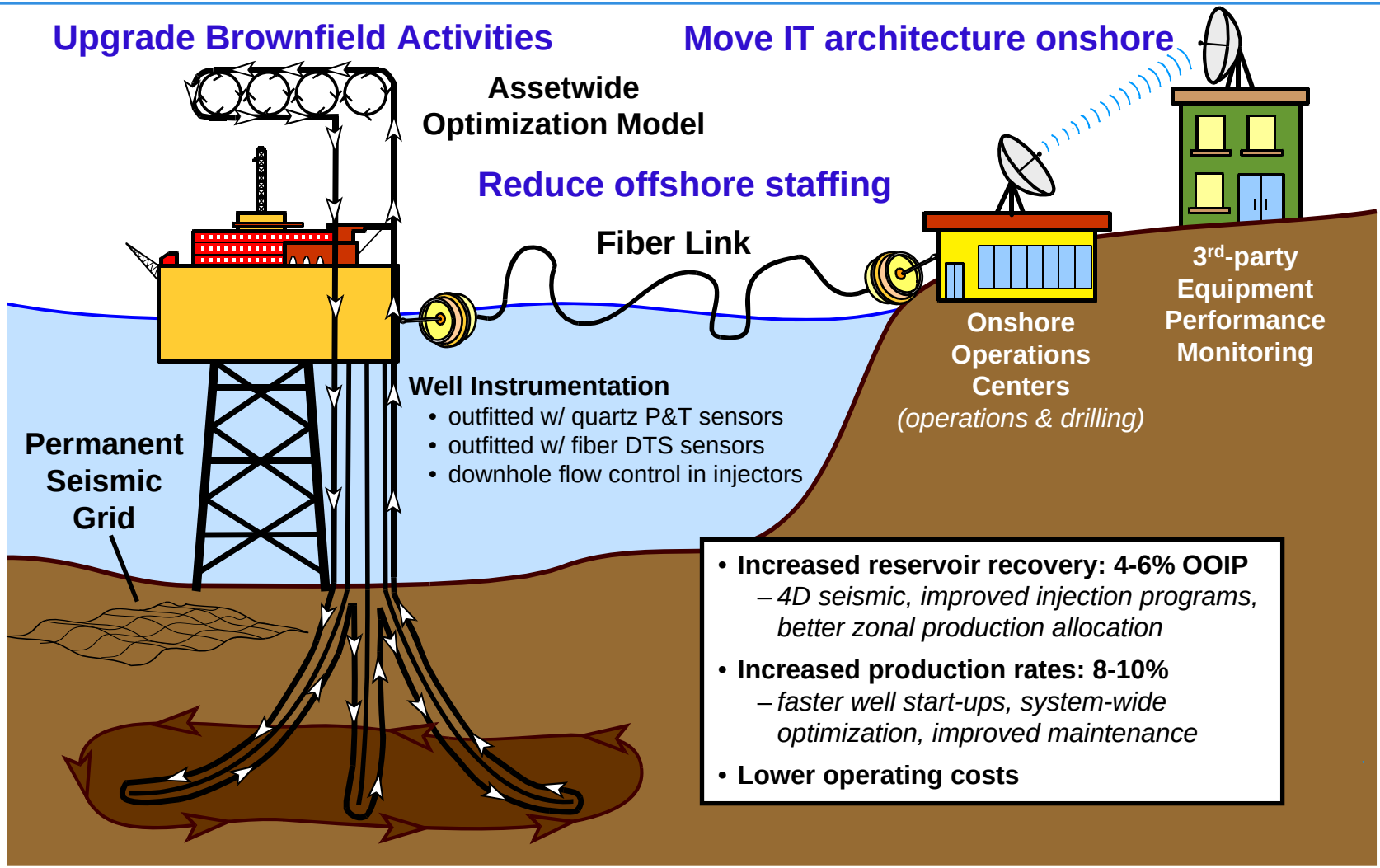
Field Case Study: Shallow-water Oil



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Field Case Study:

- Integrated Field Planning (IFP)
  - Improve on-time project completion rates 30% to 90%
- Align and simplify organization with IFP and efficiencies of centralized operations centers
  - Lower capex by 5% (workforce productivity)
- Embrace continuous improvement mentality

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Concluding Comments

- The World is not running out of oil & gas resources
  - Hydrocarbons continue to be critical to meet energy demand
  - Industry shift to unconventional and brownfield & frontier resources to increase supplies
- Increased state control limits IOC access to resources
- Cost increases, shift to unconventional resources and climate change policies are three prime drivers of changes in technologies, business processes and strategies
- Companies adopt collaborative approaches to resolve community & environmental concerns while delivering O&G supplies through efficient manufacturing-like processes.
- Confrontation between environmental / climate change policies and energy security may intensify through the balance of this decade

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