

Environmental Performance of the Exploration and Production Industry: Past, Present, and Future

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Presentation Outline

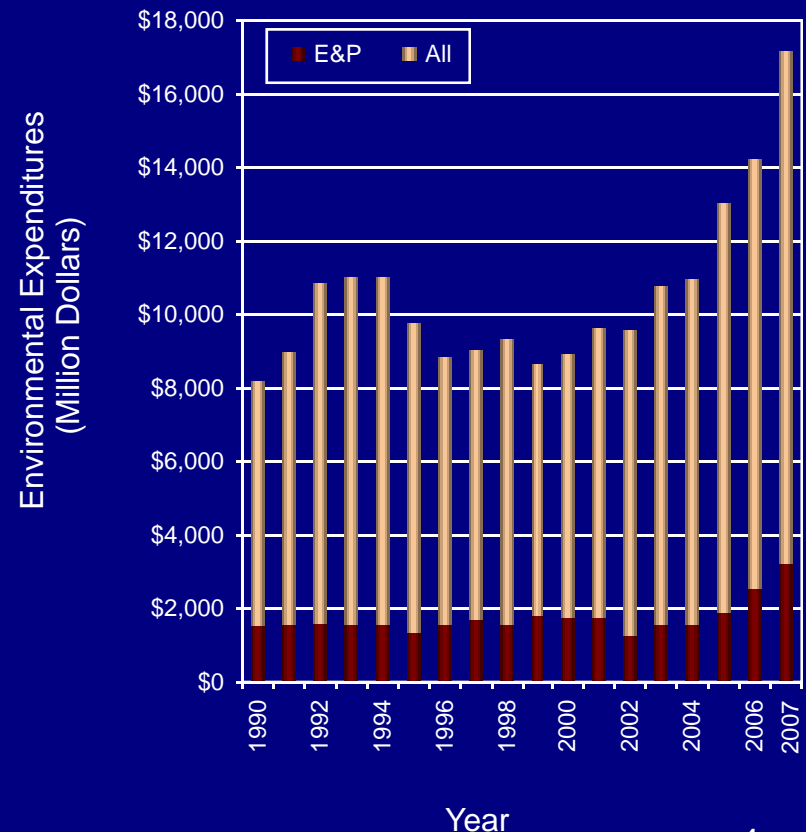
- The Past
 - Historical E&P environmental performance
- The Present
 - Environmental benefits from technological advances
 - Business drivers for environmental performance
- The Future
 - Environmental value from existing infrastructure
 - Economically addressing global climate concerns

THE PAST

Expenditures on Environmental Activities by the U.S. Petroleum Industry

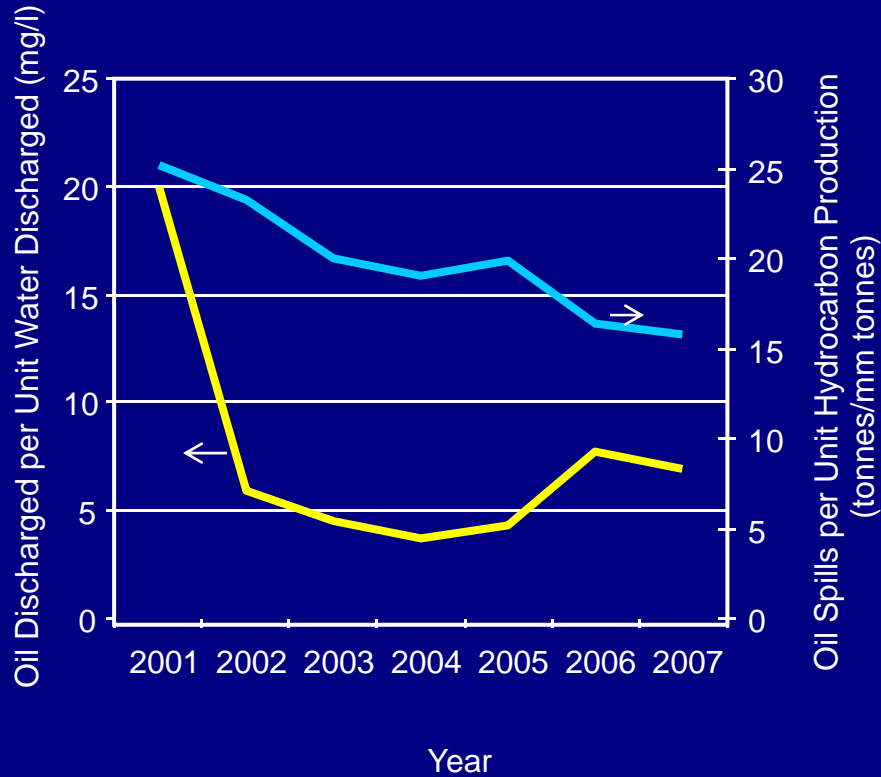
- U.S. overall petroleum industry spending
 - Since 1990, nearly \$175 billion
 - Averaged nearly \$9 billion per year for last decade
 - In last decade, increased 80%
- U.S. E&P spending
 - Since 1990, over \$31 billion
 - Averaged over \$1.9 billion per year for last decade
 - In last decade, increased over 100%

Environmental Expenditures of the U.S. Petroleum Industry (1990-2006)

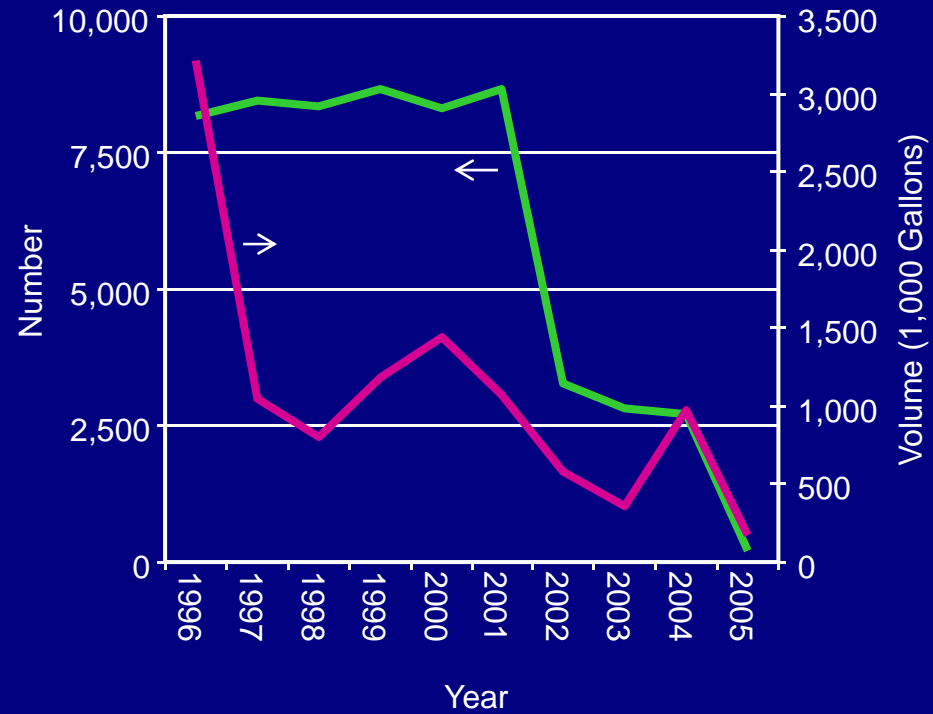


Oil Spill Frequency of the Petroleum Industry

Worldwide



Oil Spills in U.S. Waters

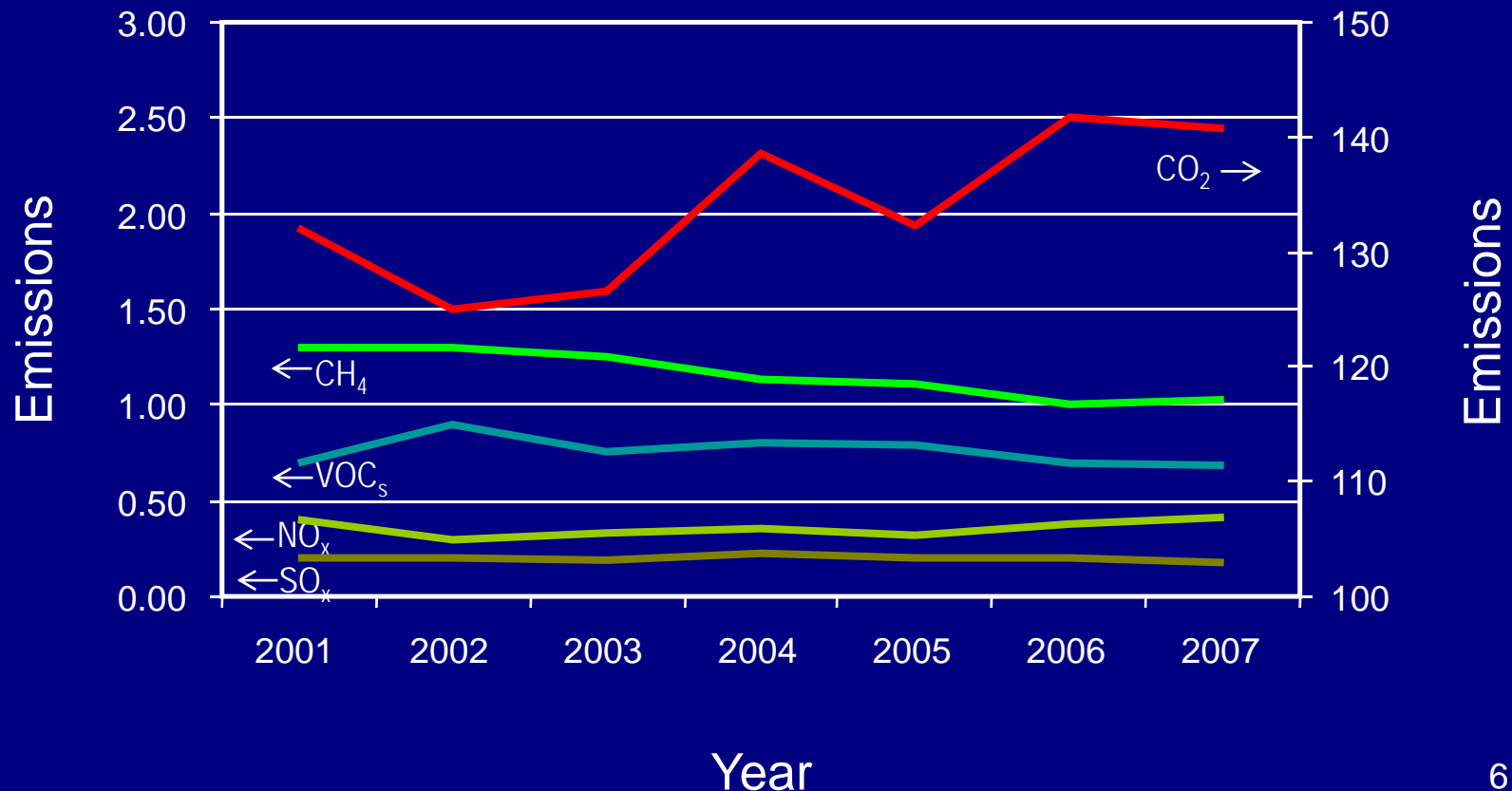


Source: International Association of Oil and Gas Producers

Source: U.S. Coast Guard, American Petroleum Institute

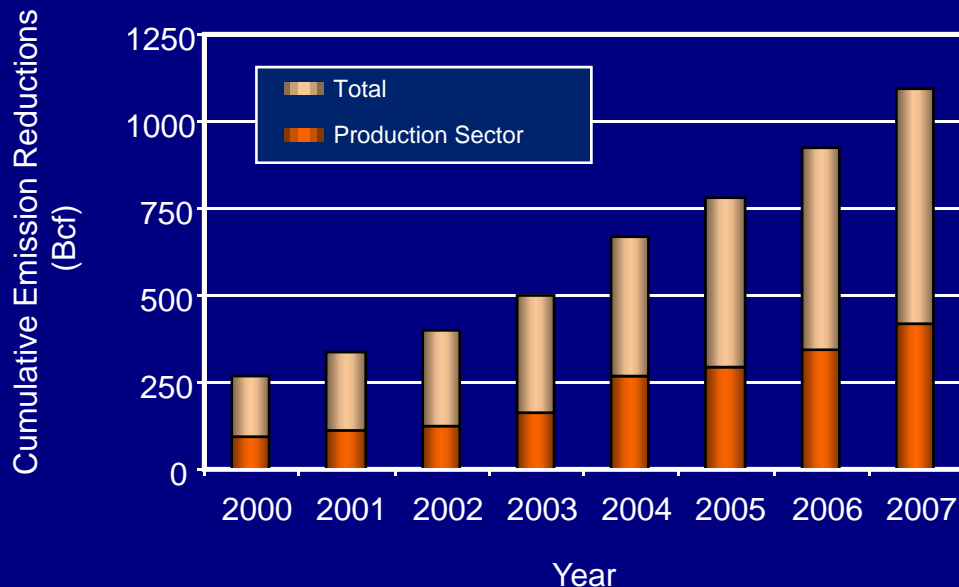
Reducing Emissions from Global Oil and Gas Industry Operations

Emissions (tonnes per 1000 tonnes production)



Voluntarily Reducing Methane Emissions from U.S. Oil and Gas Industry Operations

Cumulative Methane Emission Reductions by EPA Natural Gas STAR Partners (1993-2007)



- Since 1990, Natural Gas Star partners eliminated 677 Bcf of methane emissions
- 417 Bcf eliminated from the production sector alone
- One study estimated the oil and gas industry has spent \$10 billion to reduce fugitive methane emissions

Source: U.S. Environmental Protection Agency (www.epa.gov.gasstar/accomplish.htm)



THE PRESENT

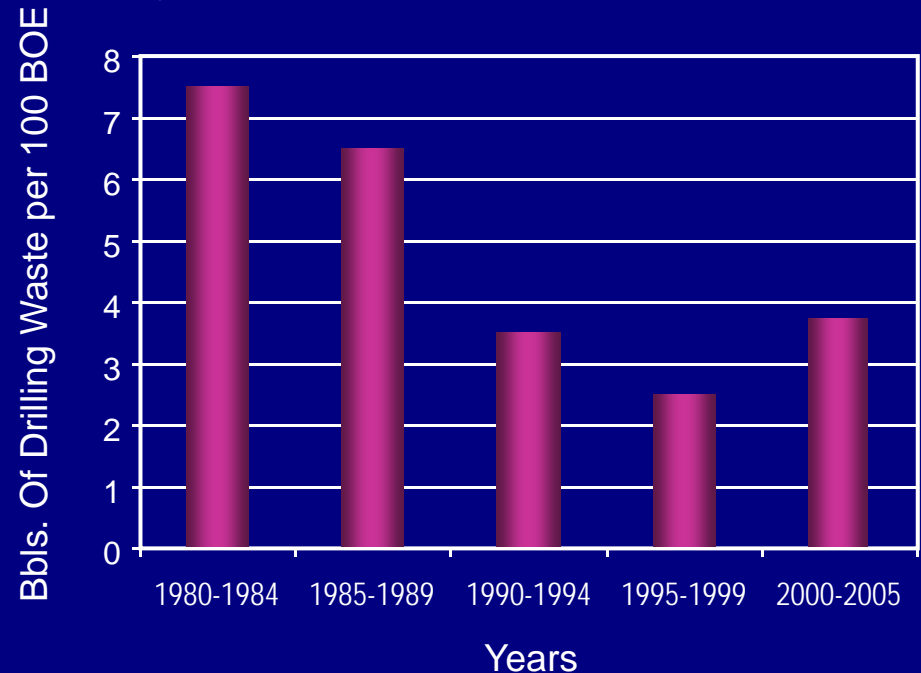
Improved Efficiency in U.S. E&P Due to Technological Advance



The Result – Greater Efficiency Means Reduced Environmental Impacts

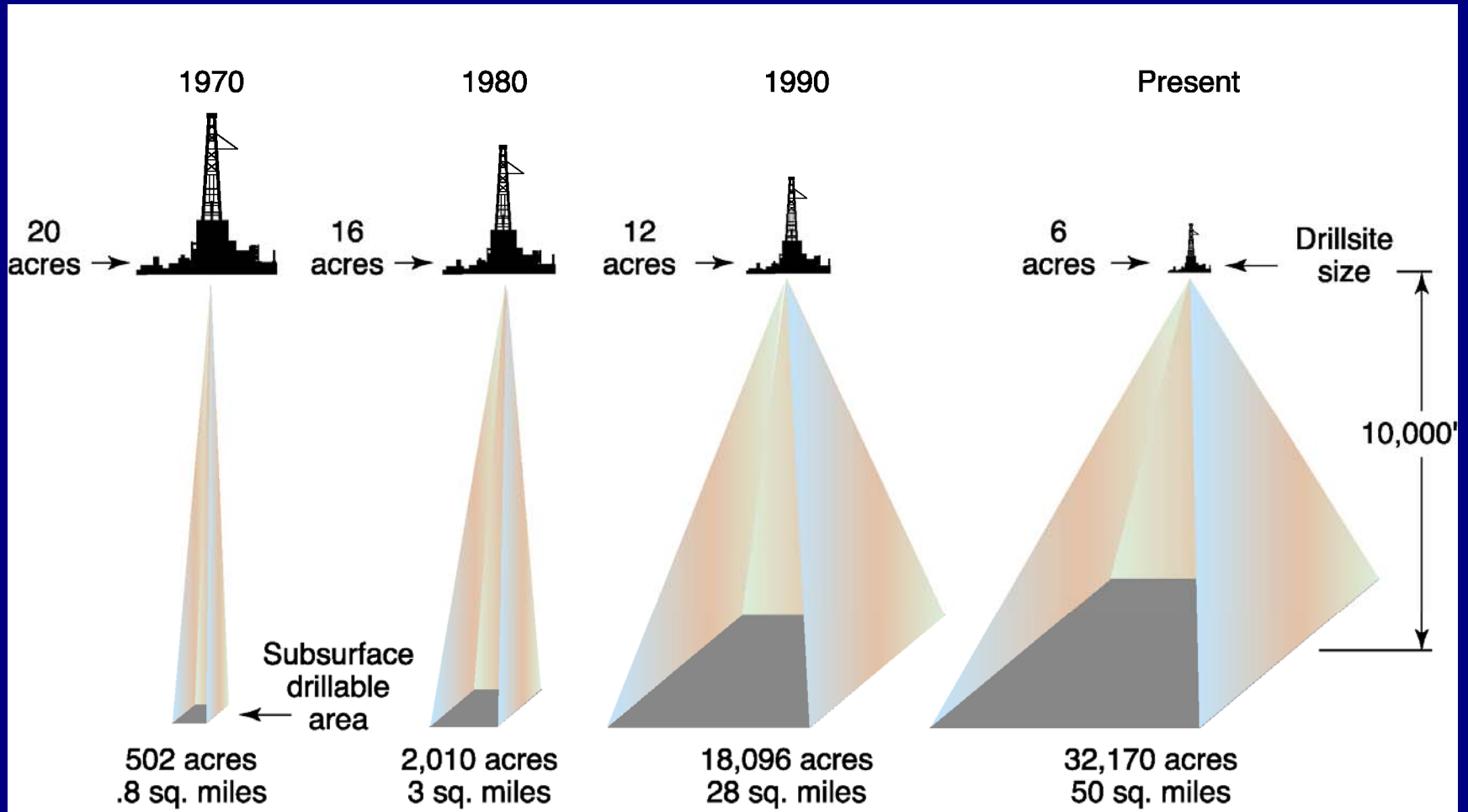
- Fewer wells required to add the same reserves
 - U.S. industry adds 2 times more to the reserve base per well than in the 1980s
- Lower waste volumes
 - Same level of additions with half the generated waste
- Smaller footprints
 - The average well site footprint 30% of its size in 1970
 - With extended reach drilling, a well can contact over 60 times more subsurface area

Drilling Waste Generated per 100 BOE Hydrocarbon Reserve Additions in U.S.



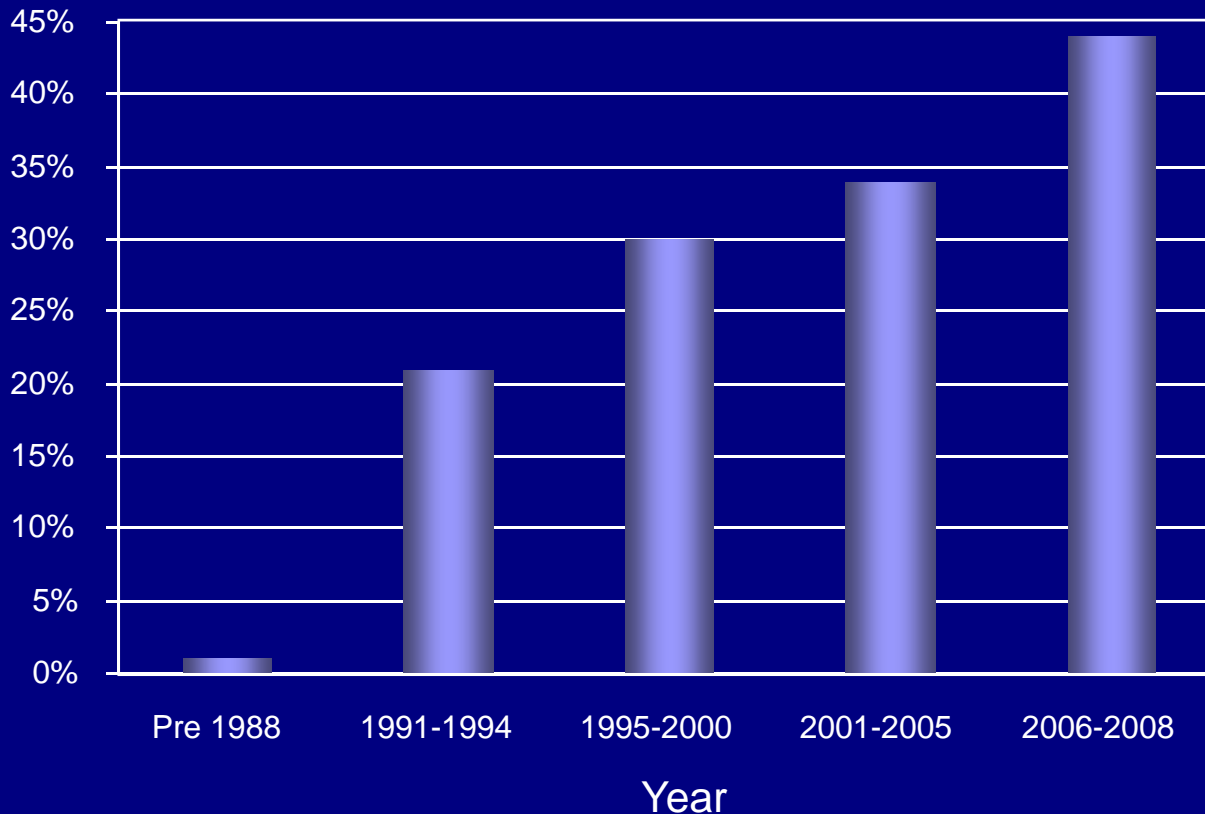
Source: Energy Information Administration and American Petroleum Institute

Shrinking the Surface Footprint While Expanding the Subsurface Contact Area



Reaching Farther -- Horizontal, Directional, and Multilateral Drilling

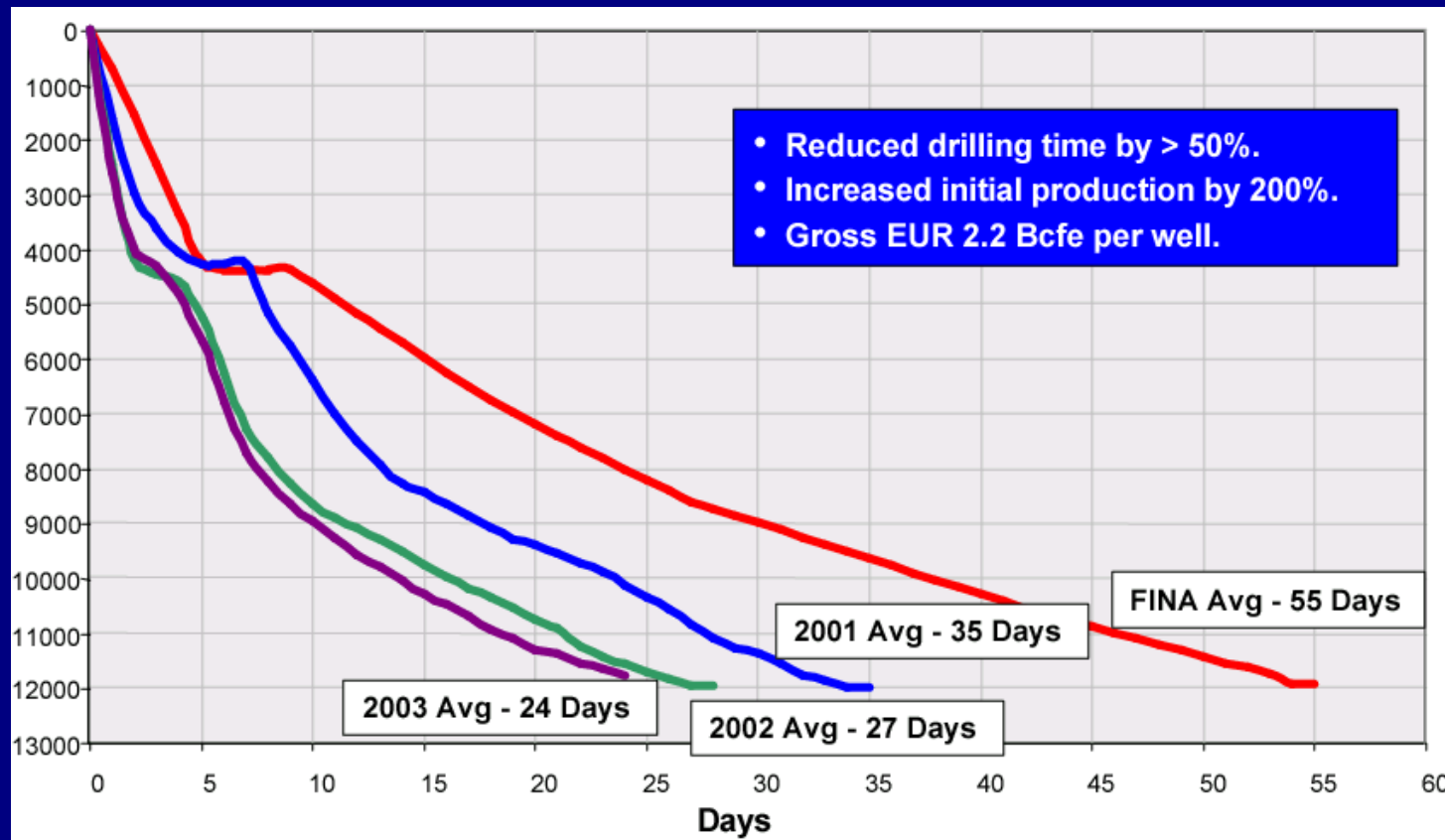
Portion of U.S. Rig Fleet Drilling Horizontal and/or Directional Wells



- Today, over 44% of U.S. wells are horizontal or directional wells
- Double the rate drilled in the early 1990s

Drilling Faster and More Efficiently Leads to Reduced Environmental Impacts

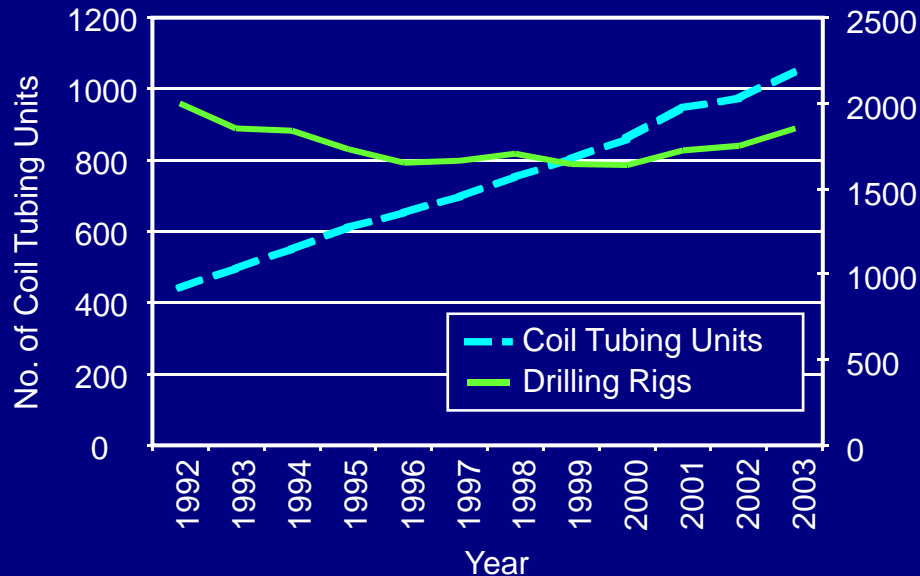
Overton Field, East Texas
(Cotton Valley Tight Gas Sands)



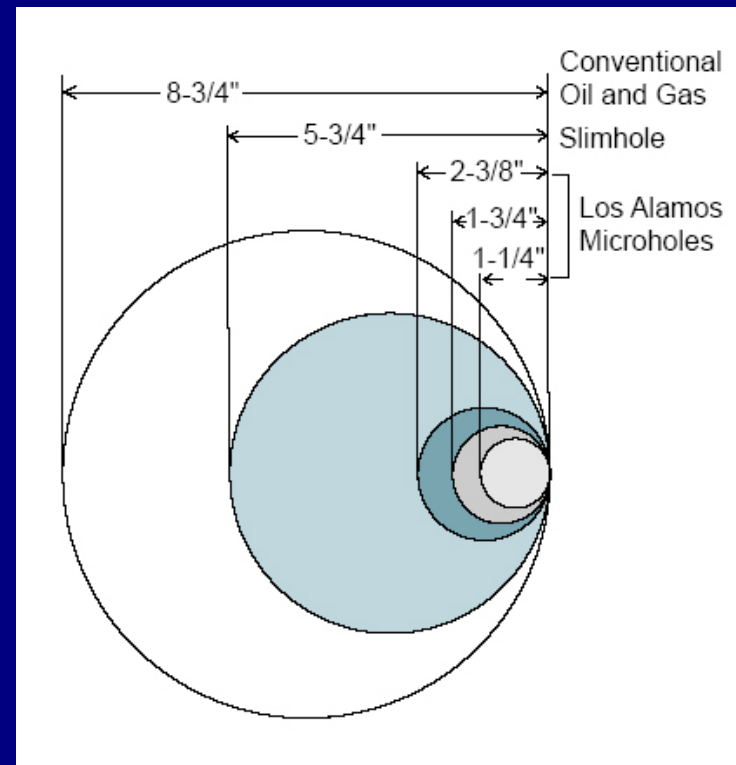
Source: Southwestern Energy Company, 2008

Small is Beautiful -- Environmental Benefits of Slimholes/Coiled Tubing

Growth in Coiled Tubing Units in the Last Decade



Slimholes Generate Less Waste, Emissions, and Drill Site Footprints

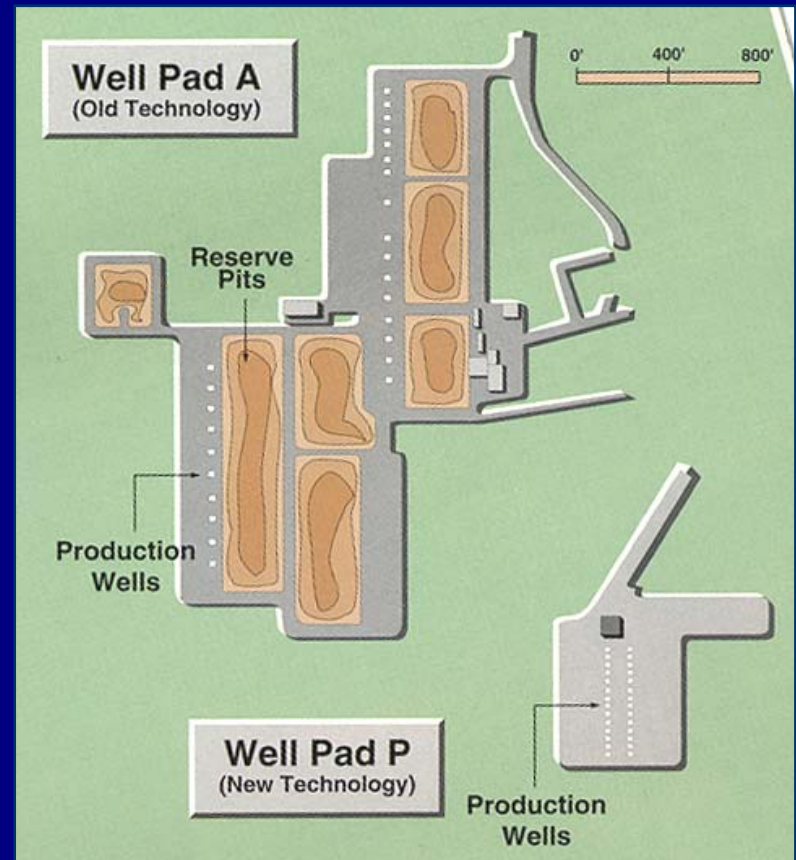


Source: Raymond James and Associates, Inc. in "Industry Trends," Oil and Gas Journal, April 29, 2002, p. 7.

Environmental Improvements Lead to Economic Benefits on Alaska North Slope

- Spacing between wellheads
 - Reduced by over 90%
- Gravel for development pads
 - Area reduced by over 75%
- Gravel roads for pipeline construction
 - Eliminated
- Gravel well pads
 - Replaced by ice pads
- Surface disposal of wastes
 - Replaced by annular injection
 - 95% of wastes recycled

Illustration of Impact of Smaller Footprint of North Slope Operations



Source: Alaska Department of Natural Resources

“It’s Not Easy Being Green”*

The “Business” of Environmental Performance

- Greater focus on “triple bottom line”
 - Financial, environmental, social
- Evolving stakeholder expectations for environmental performance
 - Stricter performance standards by international funding organizations
 - Proliferation of shareholder resolutions
- More assets in socially screened investment portfolios
 - Grew by 324% between 1995 and 2007, compared to 260% growth for all assets
 - Represented 1 in 9 investment dollars

Socially Responsible Investing in the U.S.



Source: Social Investment Forum



* With apologies to Kermit

THE FUTURE

Extracting Environmental Value from Existing Assets

- In the US, ~90% of reserves added from existing fields
 - Resulting in minimal incremental impact relative to new discoveries
 - Particularly in frontier areas
- Little recognition given to this environmental value
 - In EISs, permit applications
- Greater non-oil & gas uses of infrastructure (e.g., rigs to reefs, mariculture, wind, etc.)
 - “Sustainable development”

Source: U.S. Energy Information Administration

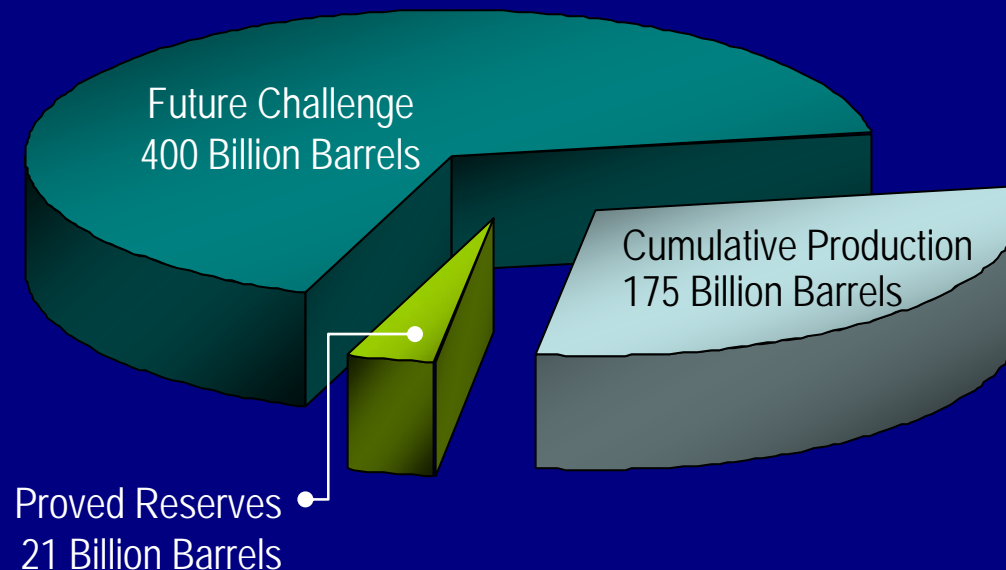
		Crude Oil	
		Lower 48	Total U.S.
% Reserve Adds			
	From New Field Discoveries	12%	11%
	From Extensions, New Pools in Old Oil Fields, Revisions, Adjustments	88%	89%
		Natural Gas	
		Lower 48	Total U.S.
% Reserve Additions			
	From New Field Discoveries	10%	10%
	From Extensions, New Pools in Old Fields, Revisions, Adjustments	90%	90%

Storing CO₂ with Enhanced Oil Recovery (EOR): Large “Value-Added” Market for CO₂ Emissions

Large Volumes Of Domestic Oil Remain “Stranded” After Traditional
Primary/Secondary Oil Recovery

Original Oil In-Place: 596 B Barrels*

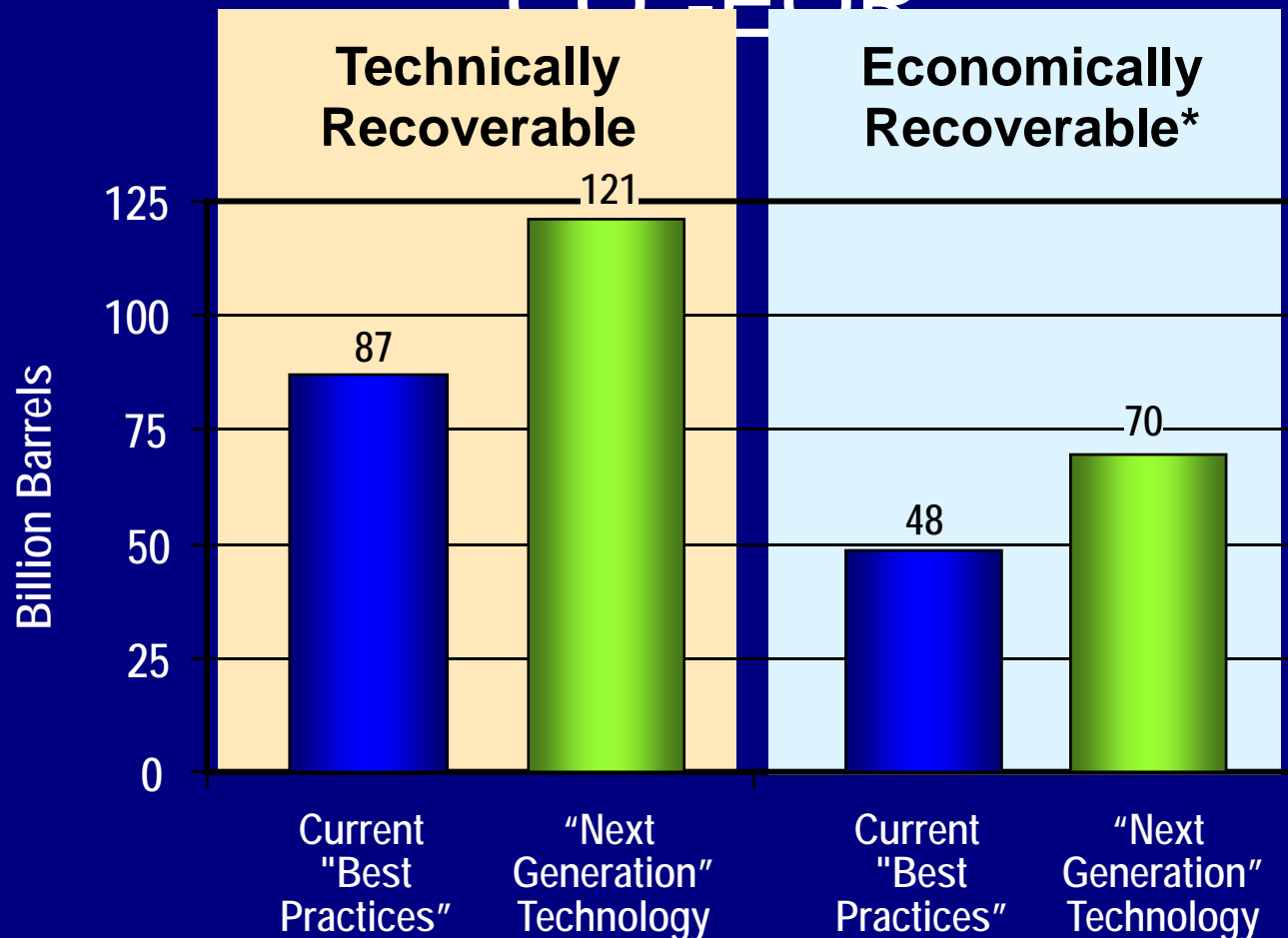
“Stranded” Oil In-Place: 400 B Barrels*



*Based on field-by-field assessment of over 2,011 large U.S. oil fields accounting for 74% of domestic oil production; excludes deep-water GOM.

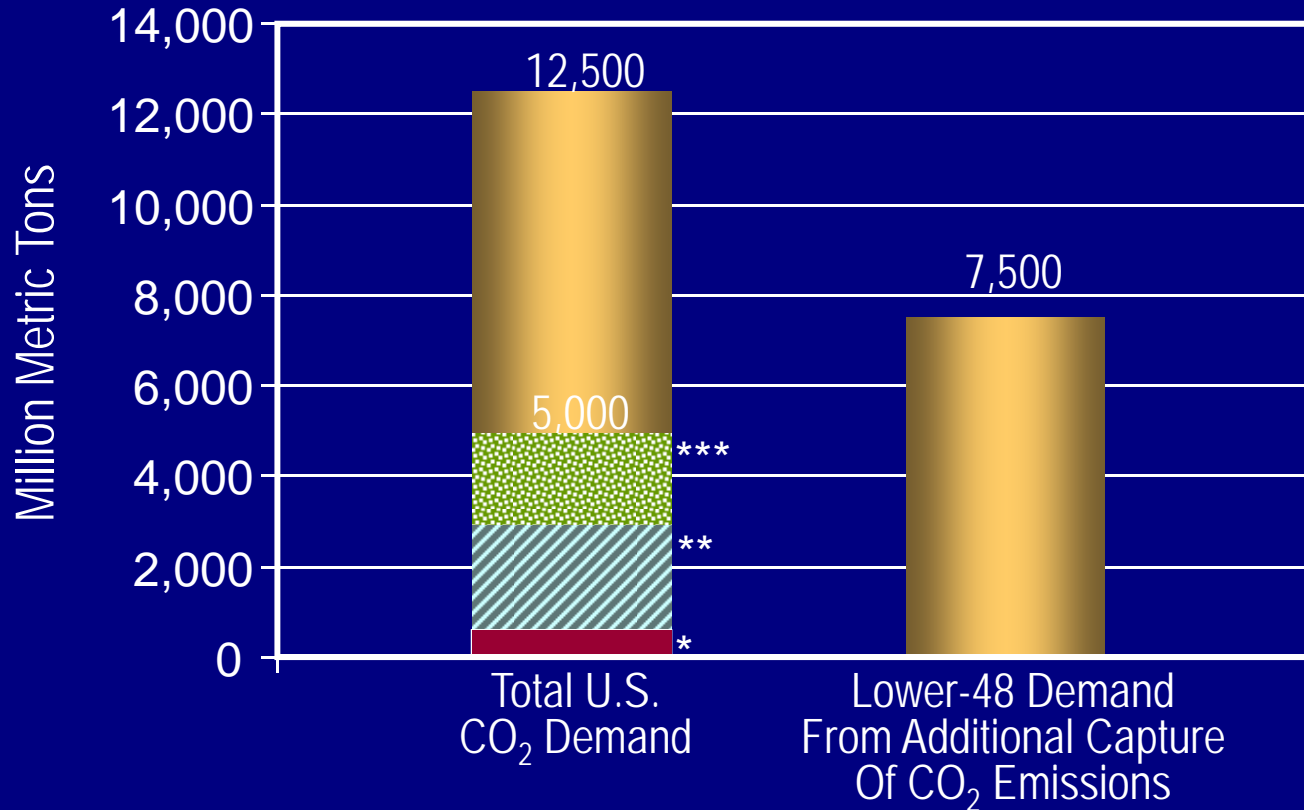
Source: Advanced Resources International (2008)

Domestic Oil Resources Technically and Economically Recoverable with



*Assuming oil price of \$100/B (real); CO₂ costs (delivered to field at pressure) of \$60/metric ton; and RoR of 15% (real) before tax.

Market Demand for CO₂ by the Enhanced Oil Recovery Industry⁽¹⁾



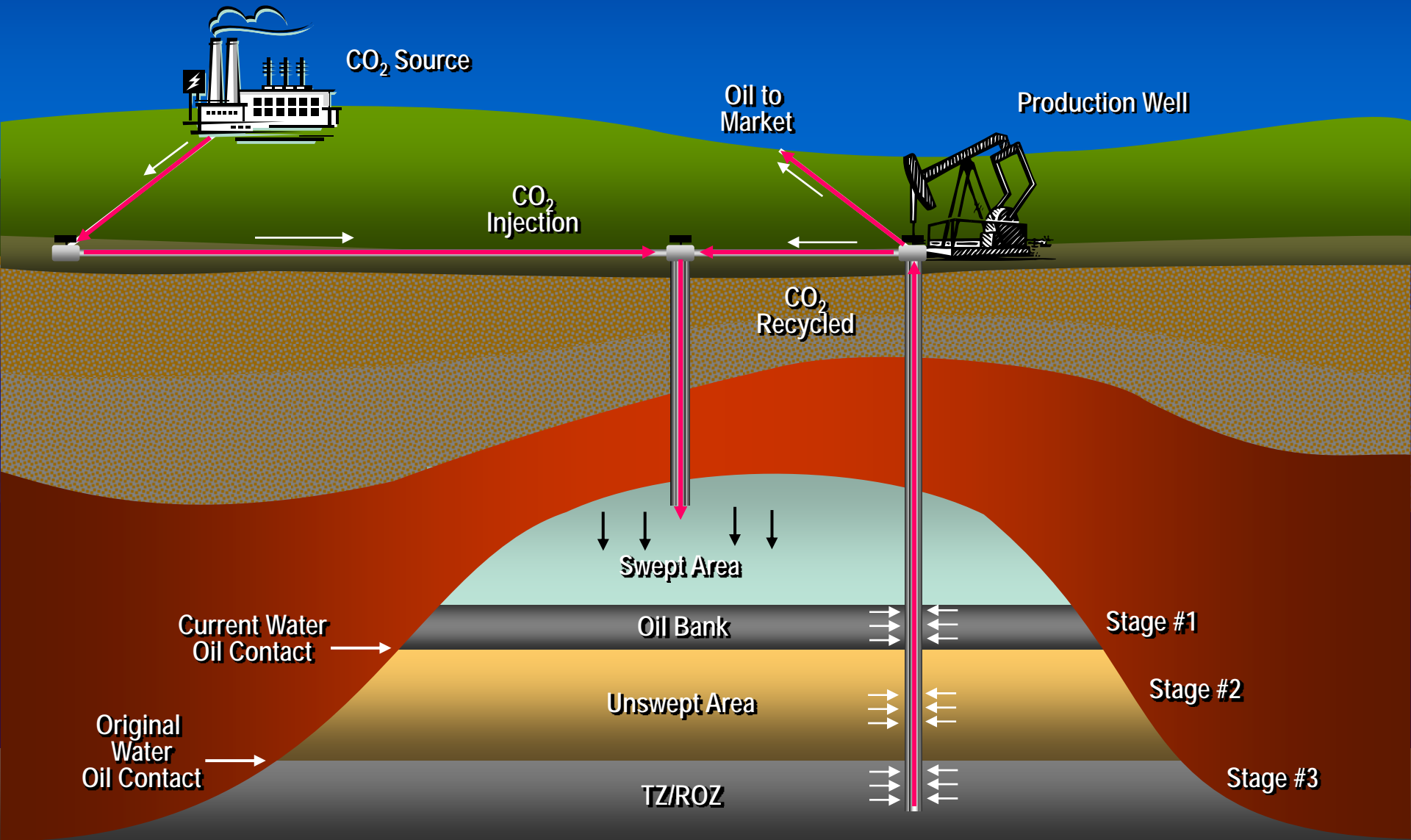
*CO₂ demand already being met by on-going CO₂-EOR projects.

**CO₂ demand in Alaska for EOR.

***CO₂ demand that can be met by natural CO₂ and already being captured CO₂ emissions.

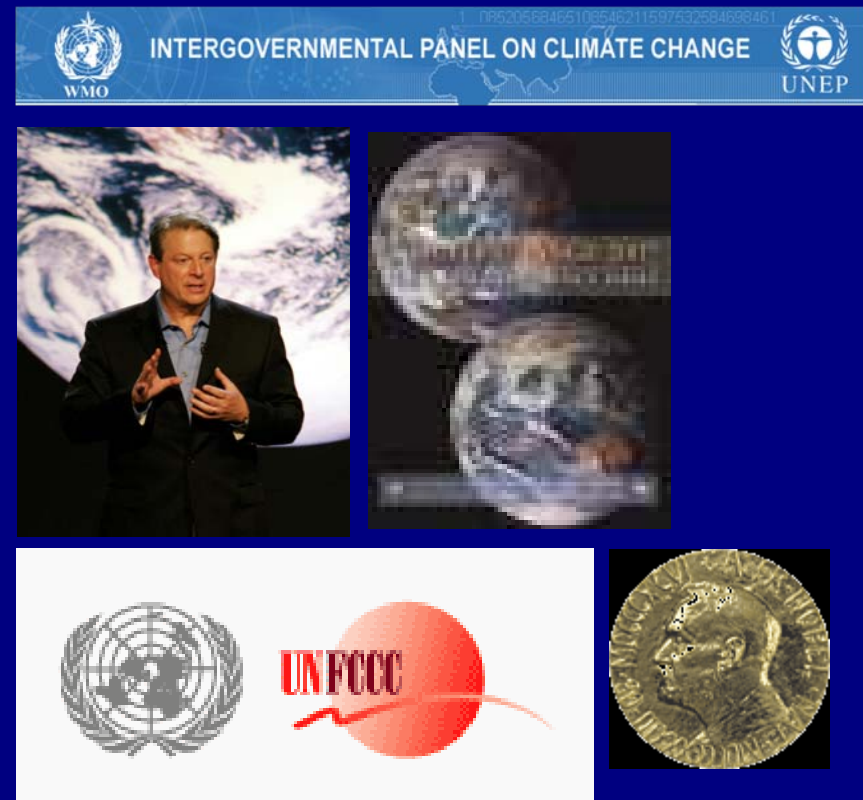
(1) CO₂ market demand for EOR at oil price of \$70/B (real), CO₂ cost of \$45/mt, and ROR of 15% (real before tax). 21

Expanding CO₂ Storage Capacity



Global Climate Concerns will Drive the Oil and Gas Business in the Coming Decades

- Public “tipping point” about need to address climate change may have been reached
 - Whether one believes in human role in climate change or not!
- In this regard, oil & gas industry is “front and center”
- Many companies are already acting based on this assumption
- The challenge -- to provide needed energy while addressing concerns about climate change



Summary



- The E&P industry has always led, is leading today, and will continue to lead in protecting the environment
- Environmental focus of industry has evolved
 - From focus on regulatory compliance to placing business value on environmental performance
- E&P environmental performance continues to improve
 - Extracting value from continual improvements in environmental performance and technology
 - Recognizing “business case” for environmental performance
- Keys to future success
 - Linking financial and environmental performance
 - Extracting maximum value from existing assets
 - Reaping benefits of technological advances
 - Confronting the challenges of global climate concerns