



24th World Gas Conference
ARGENTINA | 2009
5-9 October

The Global Energy Challenge:
Reviewing the Strategies
for Natural Gas

Overthrowing the Paradigm: The Transformation of U.S. Gas Supply

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The United States - a Pathfinder for World Gas Supply

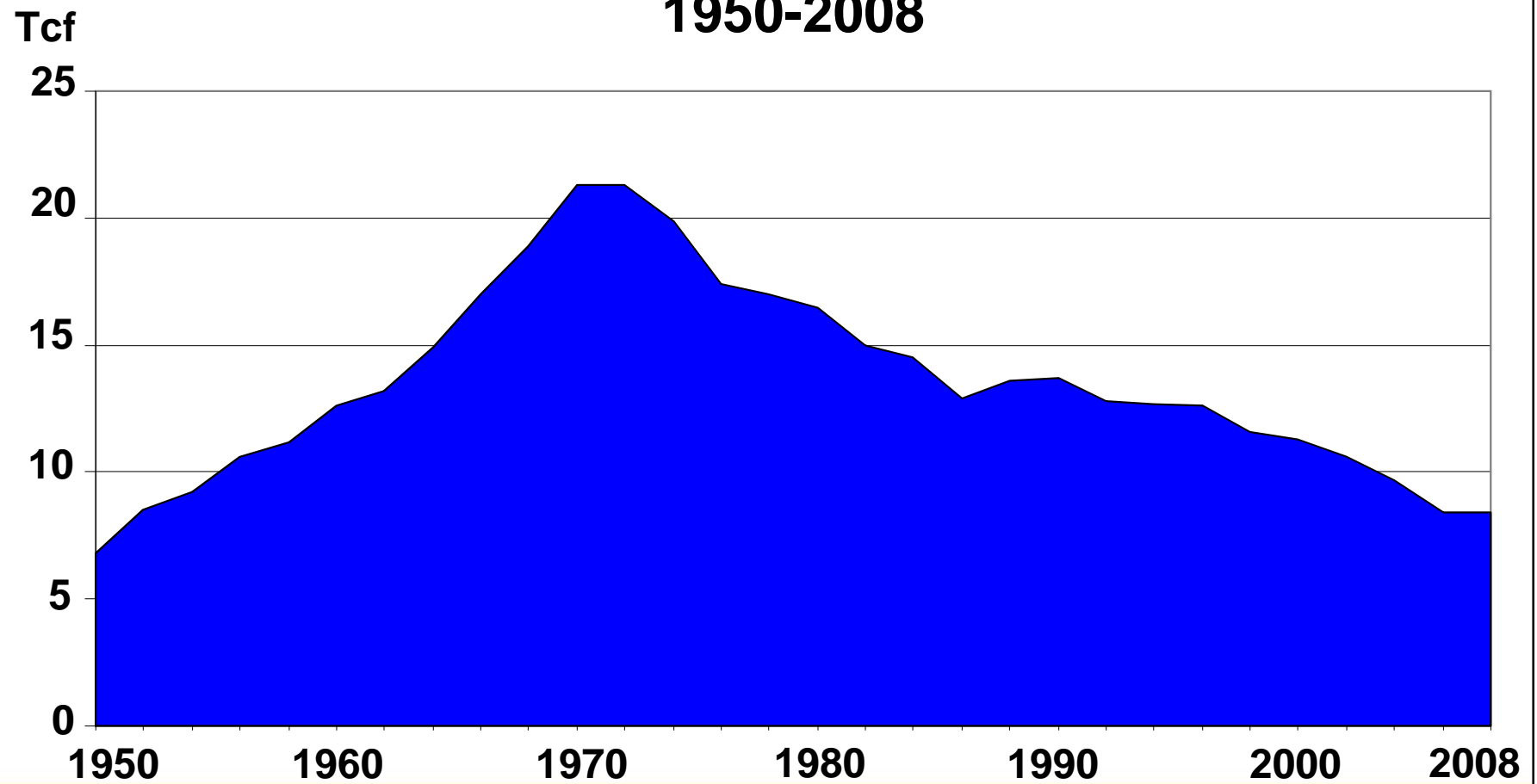
- **U.S. responses to depletion and decline provide valuable lessons for other gas-producing countries**



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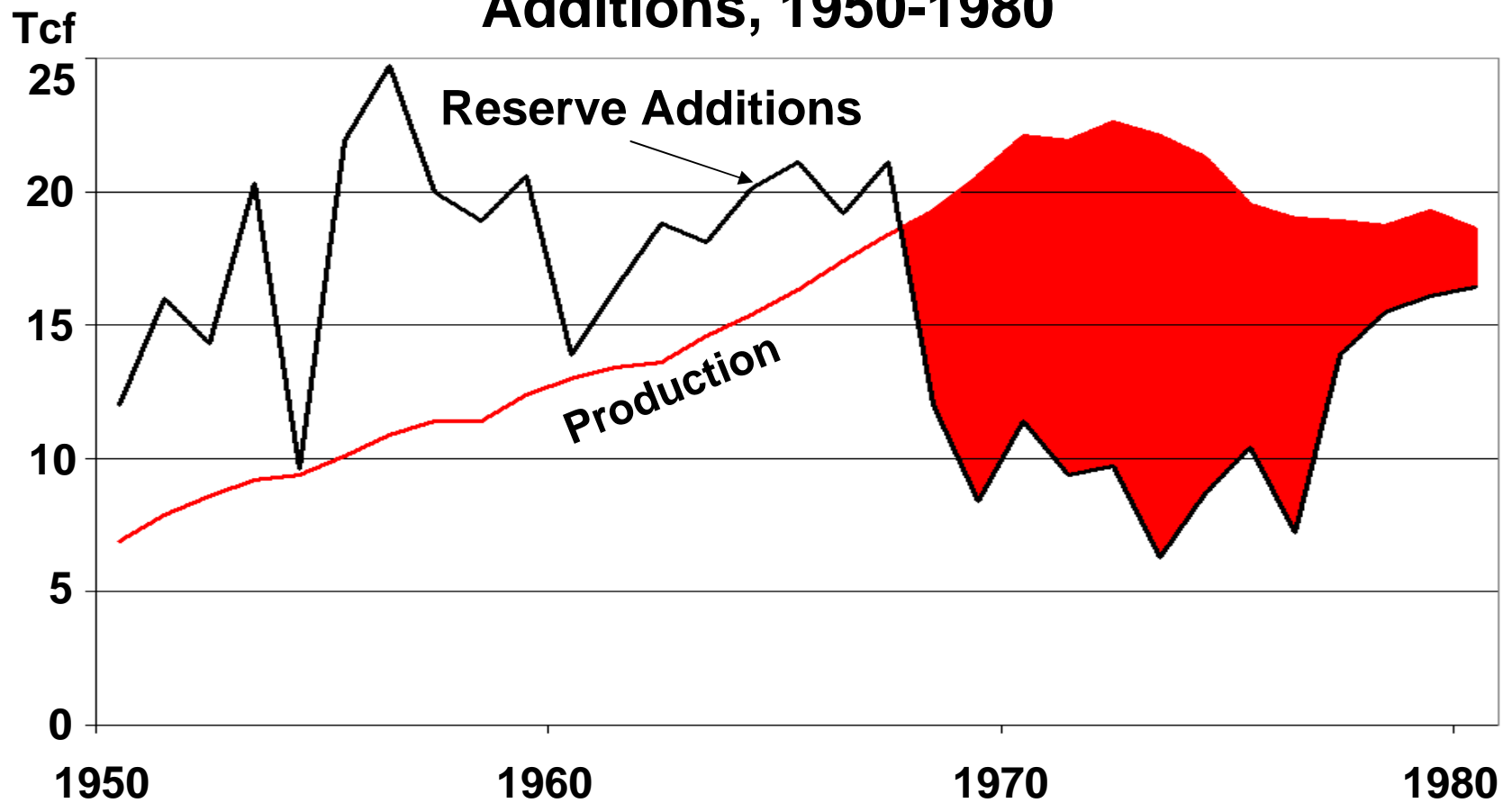
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U.S. Conventional Natural Gas Production, 1950-2008





U.S. Natural Gas Production and Gross Reserve Additions, 1950-1980





A Paradigmatic Case of Rise and Decline?

- **U.S. conventional gas production follows Hubbert's paradigm very well**
 - Initial rapid growth
 - Peaking
 - Subsequent continuous decline



Why did production decline so suddenly?

- Unusual distribution of gas resources by field size in the U.S.
- Resources concentrated in large fields
- Conventional large and giant fields discovered by 1970



Searching for Replacements

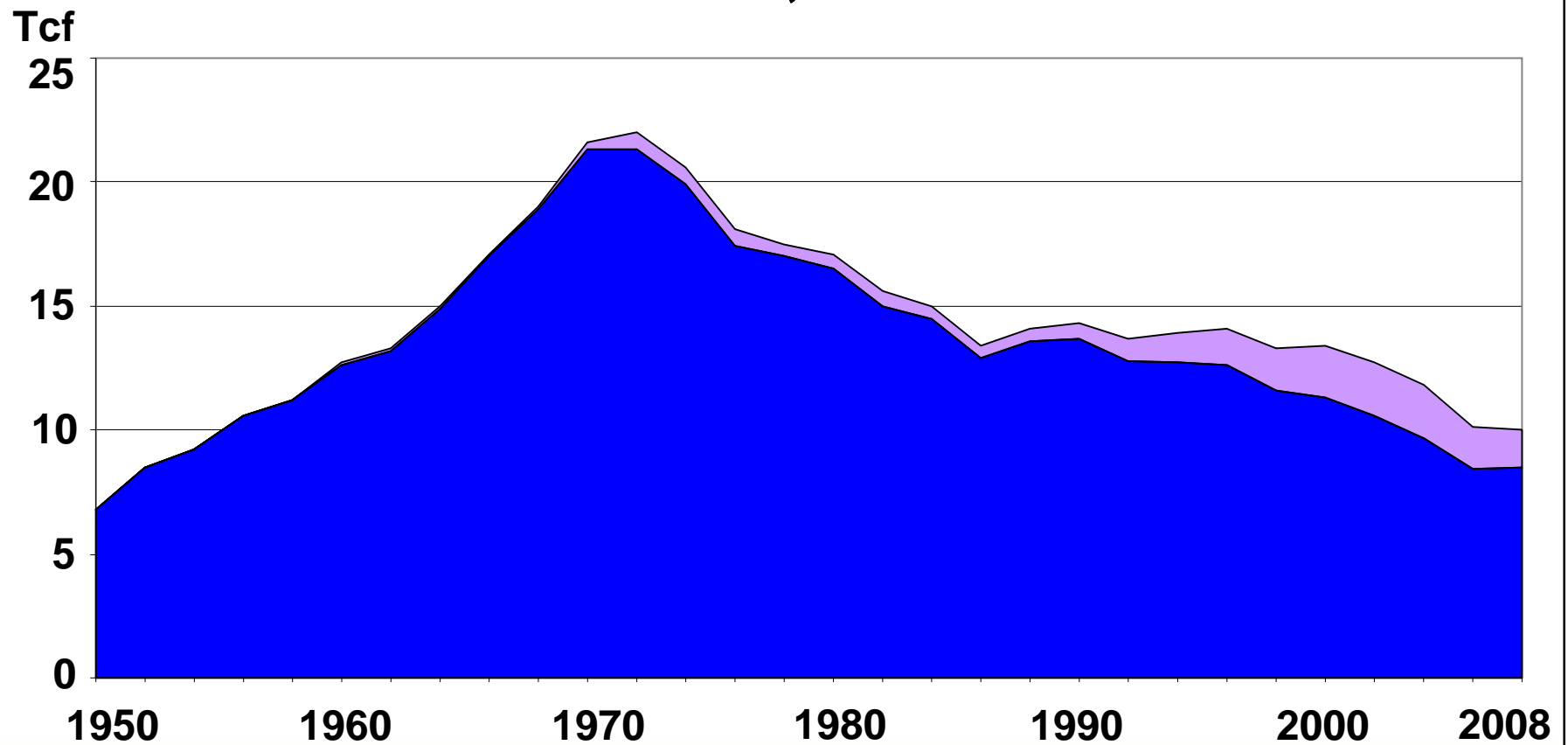
- **Search began by peak – problem was recognized early**
- **Replacements included demand limitation, imports, and synthetics**
- **Emphasized new domestic supply**
 - **Transitional**
 - **Unconventional**



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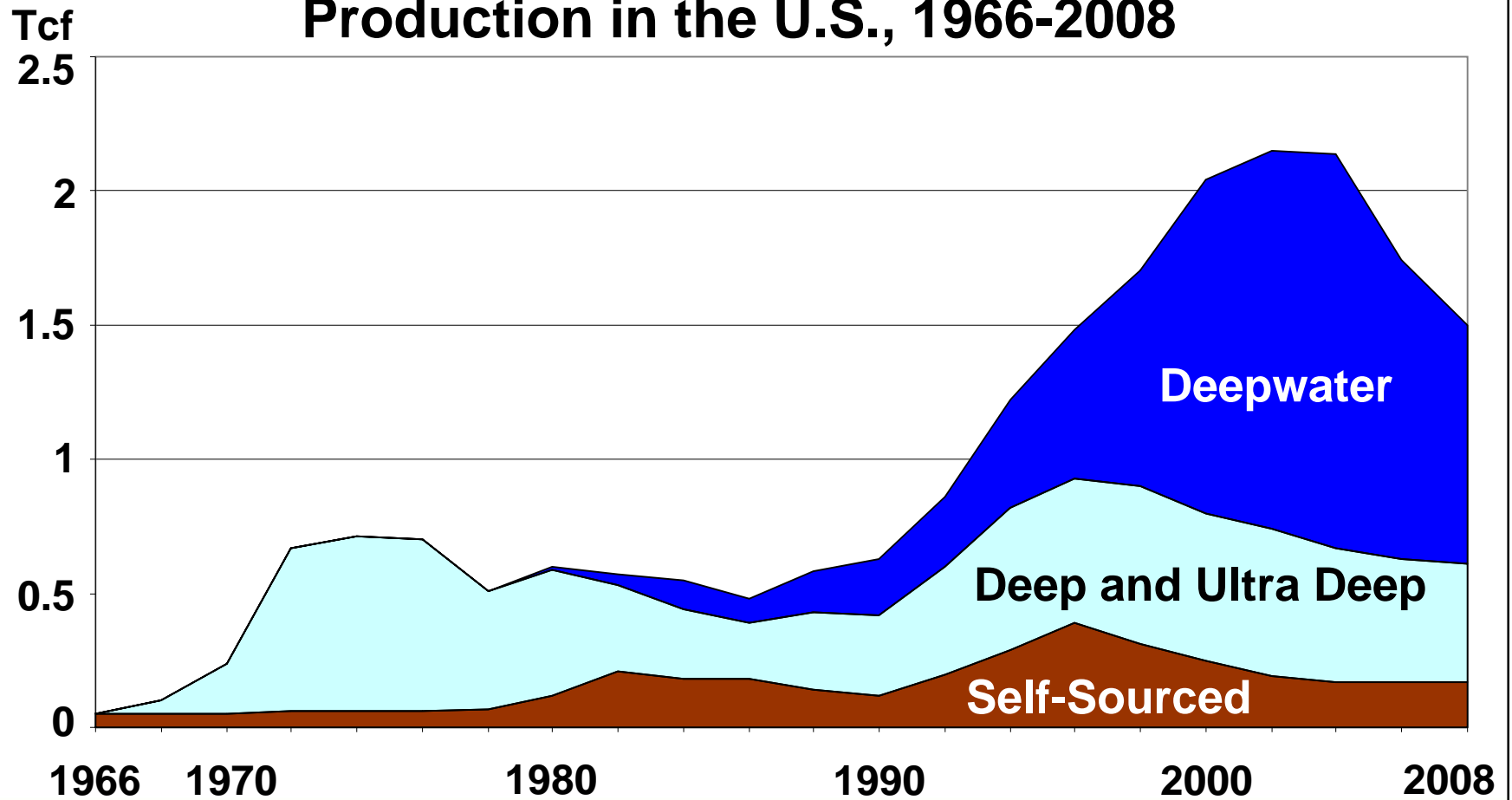
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U.S. Conventional and Transitional Natural Gas Production, 1950-2008





Composition by Type of Transitional Natural Gas Production in the U.S., 1966-2008

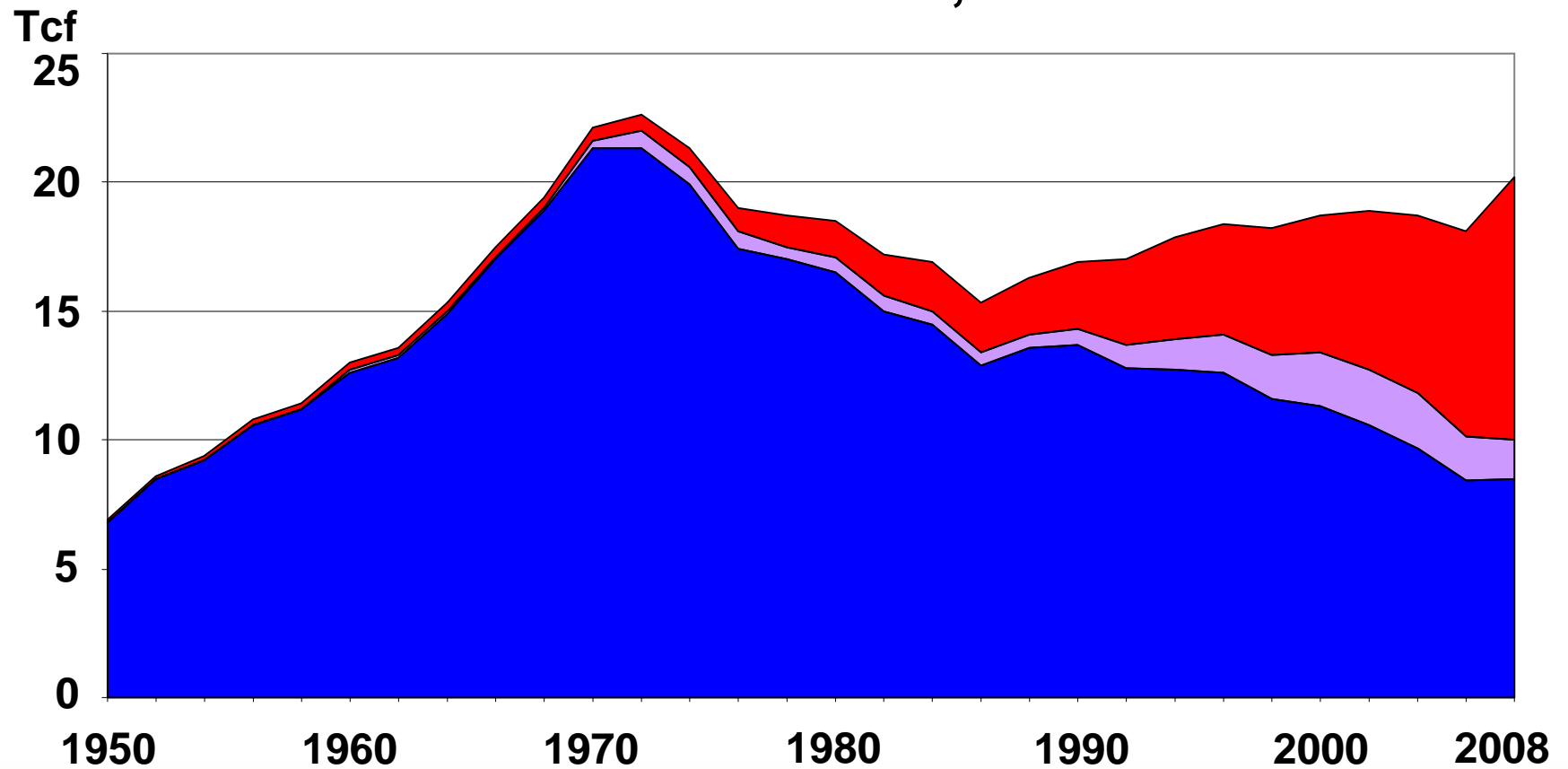




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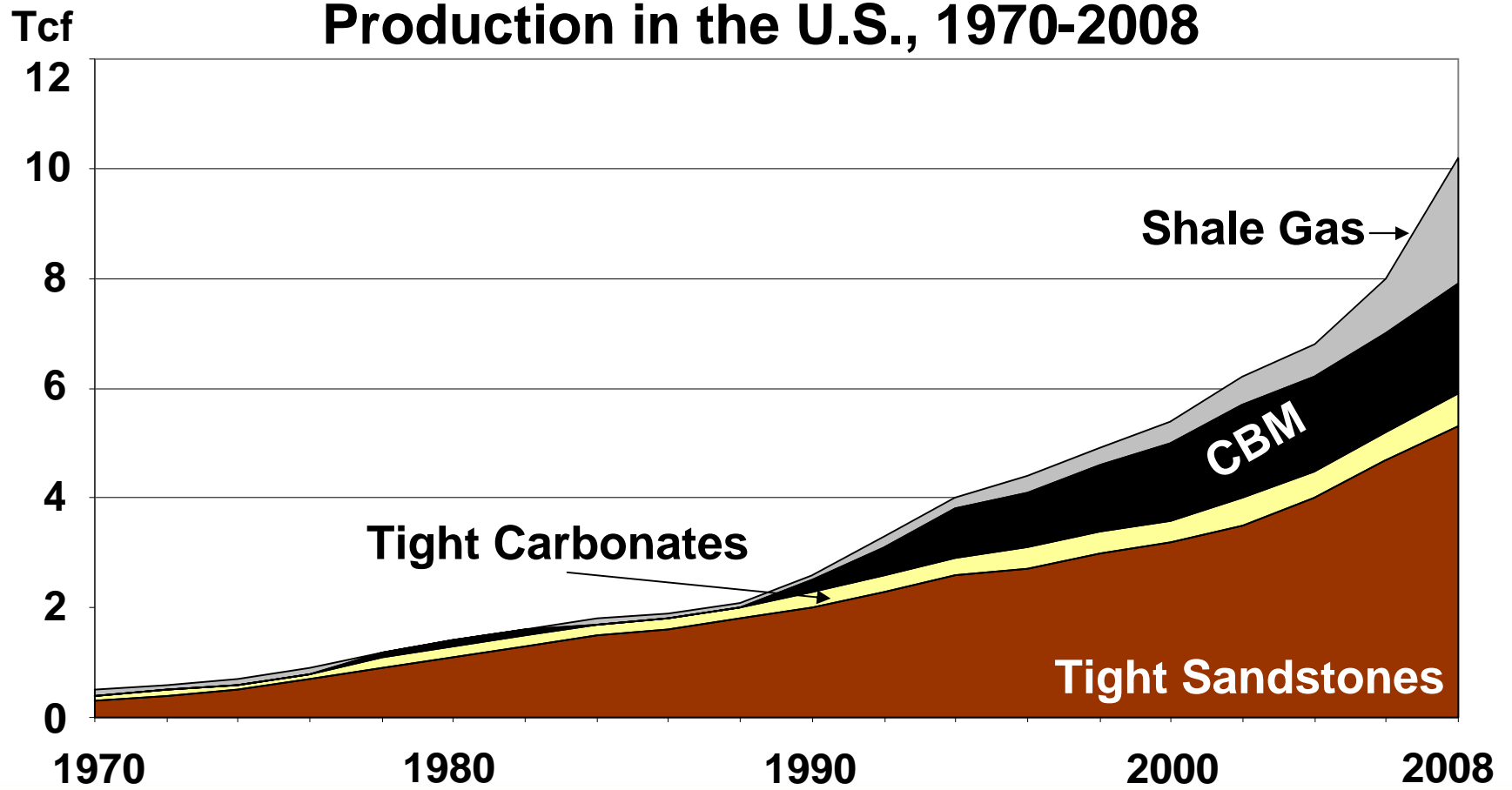
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U.S. Conventional, Transitional, and Unconventional Natural Gas Production, 1950-2008



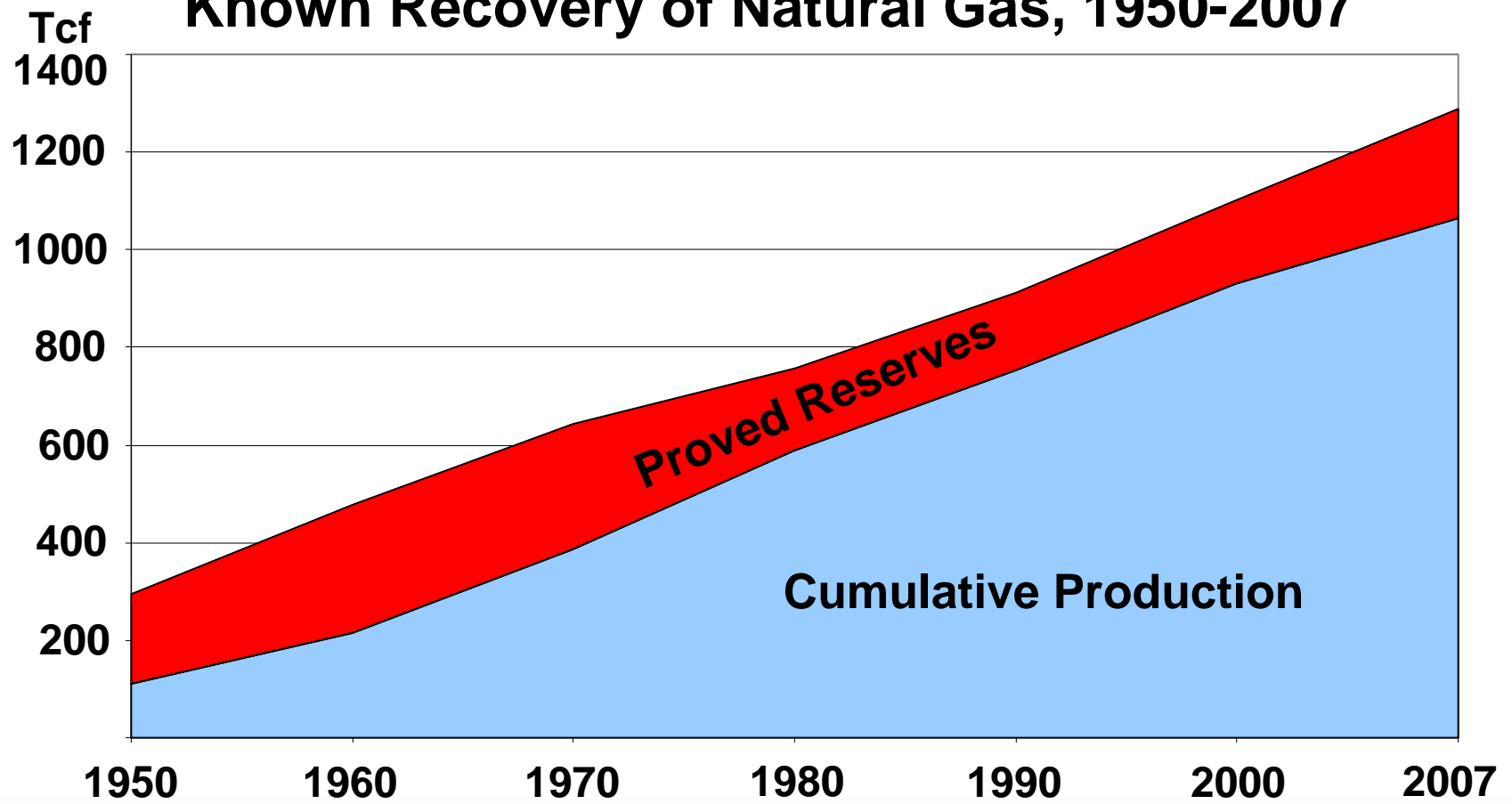


Composition by Type of Unconventional Natural Gas Production in the U.S., 1970-2008



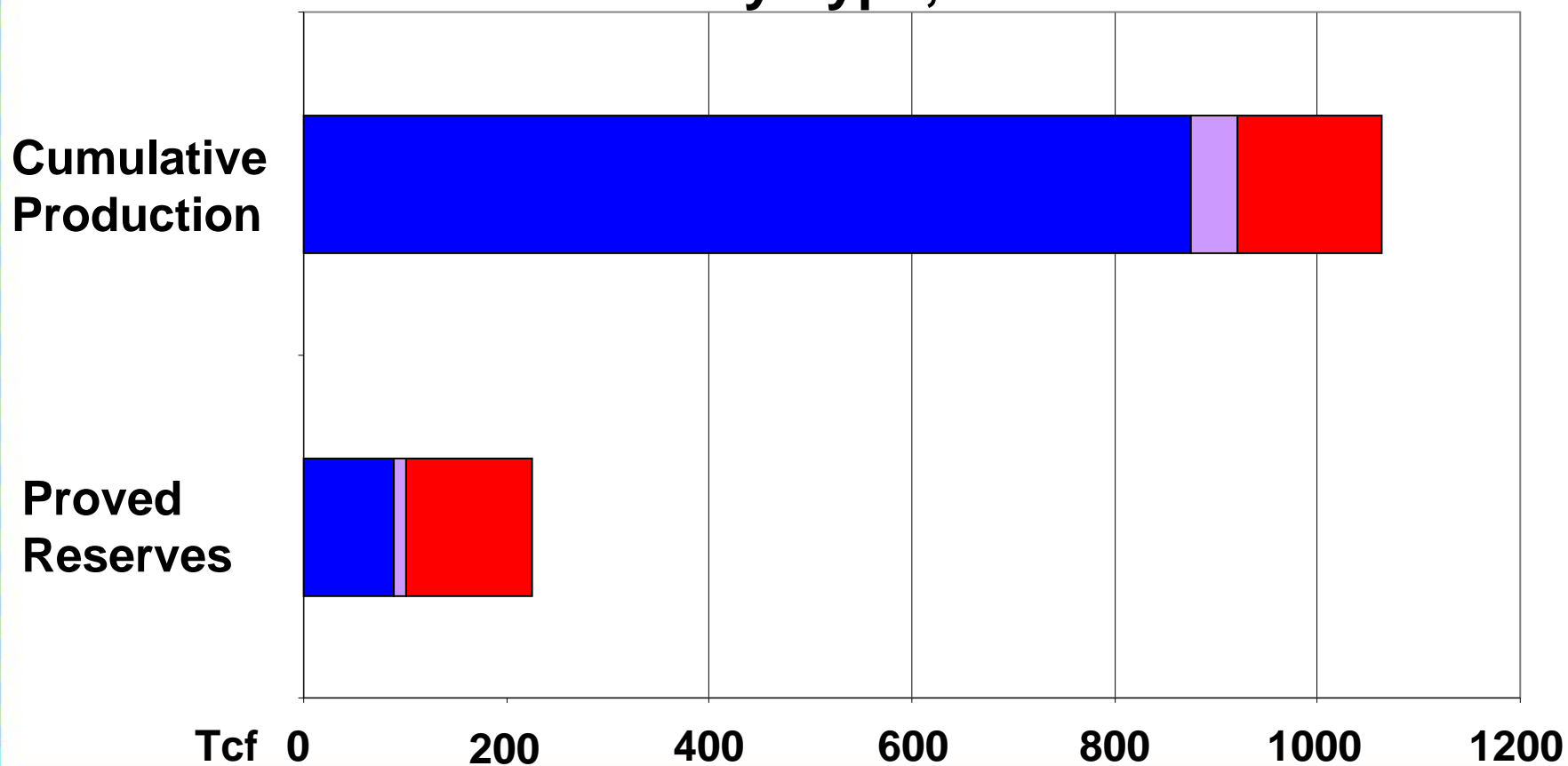


U.S. Cumulative Production, Proved Reserves, and Known Recovery of Natural Gas, 1950-2007



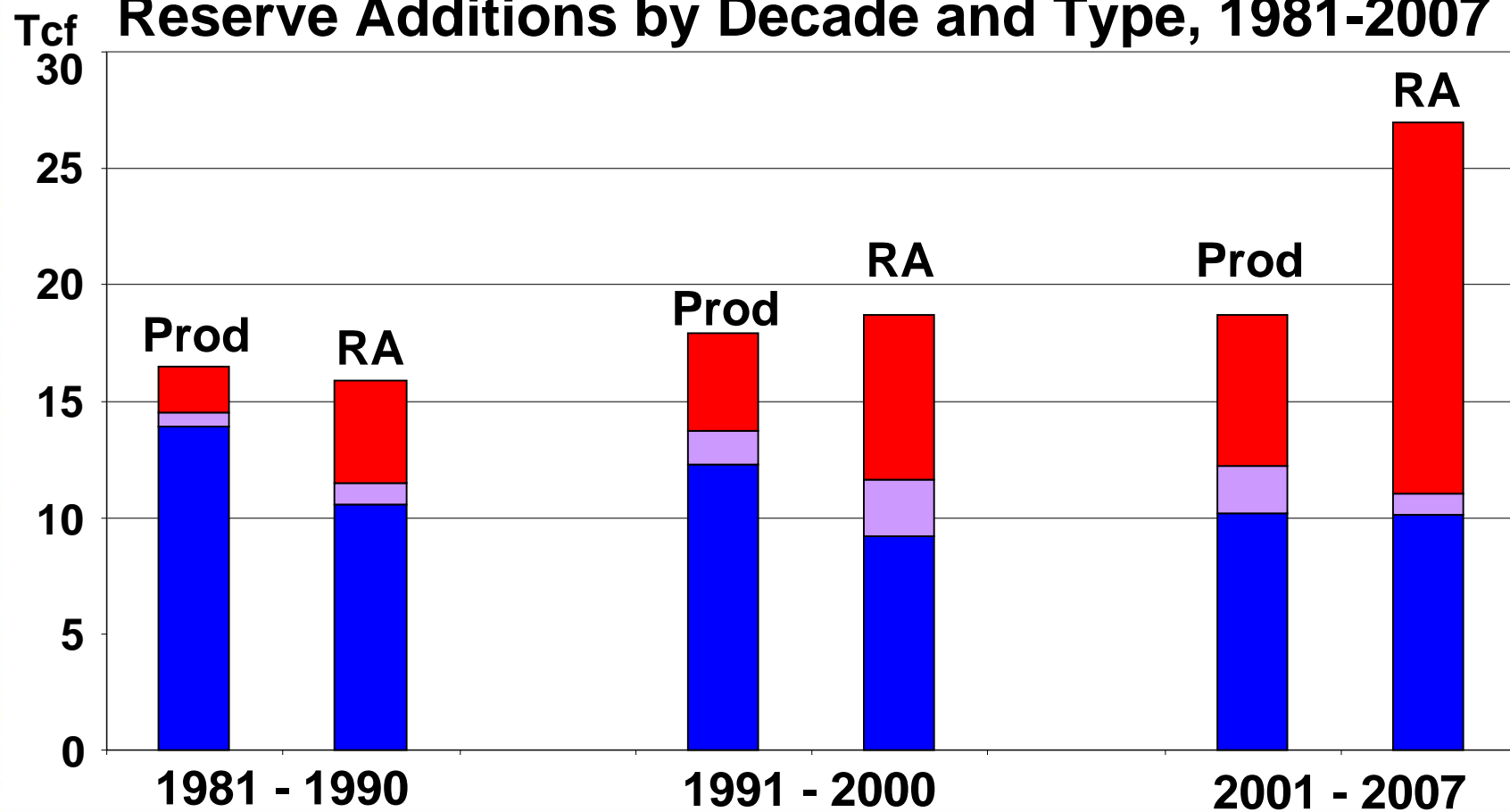


U.S. Cumulative Production and Proved Reserves of Natural Gas by Type, 12-31-2007





U.S. Average Annual Natural Gas Production & Gross Reserve Additions by Decade and Type, 1981-2007





A Limited Paradigm (1)

- **Hubbert's paradigm fits U.S. conventional gas**
-
- **Higher prices, improved technology, and new concepts have only slowed rate of decline in conventional production**

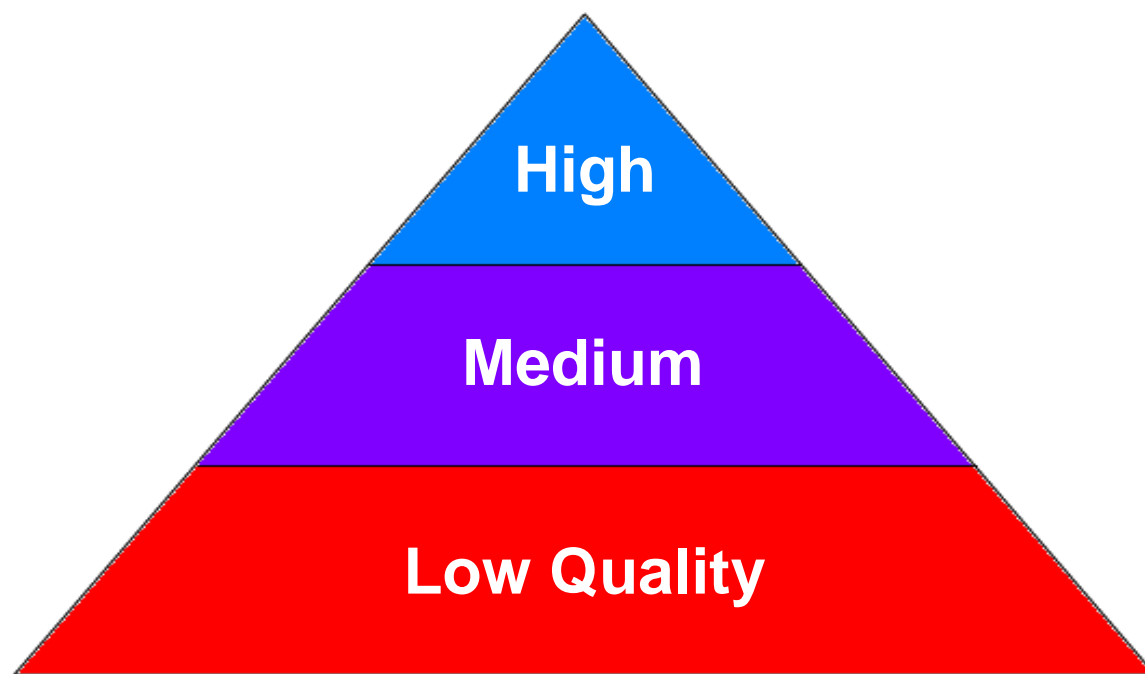


A Limited Paradigm (2)

- **Hubbert paradigm not able to incorporate unconventional gas**
- **Unconventional gas resources successfully reversed decline in production and reserves**
- **Unconventional gas only became available in significant amounts due to higher prices, improved technology, and new concepts**



A New Paradigm?



The Resource Pyramid



THE RESOURCE PYRAMID - A NEW PARADIGM?

- **Depends on ultimate size of unconventional resource**
- **Only mega plays will be truly transforming**
- **Not universally applicable**
- **U.S. experience suggests no single paradigm can explain gas supply**