# Response to Other Fossil Strategies

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# FOSSIL FUELS

Increasing demand driven by:

- Population increase
- Industrialization of China, India

Projected world annual demand increase: 2%/year

Exponential growth:

2%/year over 20 years: x 1.5 increase.

75 Mbbl/d (2002) => 110 Mbbl/d (2022)

27.4 B bbl/year => 41 B bbl/yr

History: 1.5% increase over last decade

# QUESTION: WHAT ARE RESOURCES (OIL, GAS)

!Can now answer this question!

US Geological Survey
World Petroleum Assessment 2000

- First detailed scientific assessment
- Industry, government collaboration
- 5 year effort

# THE DEBATE

Conventional petroleum reserves are finite.
Production has peaked in the US, UK, Egypt or is flat in many non-OPEC oil plays

When will world oil production peak?
What are the reserves?
Where are the reserves?
What are the alternatives?

Except there is no debate.

# UNDERSTAND THE MARKETS

How profitable is this business?

What are production costs?

- Now
- Future

"Non-OPEC finding and development costs dropped from $22/bbl in 1981 to $6/bbl in 2001 (2001$)."

E. Baird, President and CEO, Schlumberger Ltd.

*Fossil Fuels, The Key to Sustainable Development*,

World Energy, 2003, Vol 6, No. 1, p 34-41.

# CONSEQUENCES OF MARKET RULES:

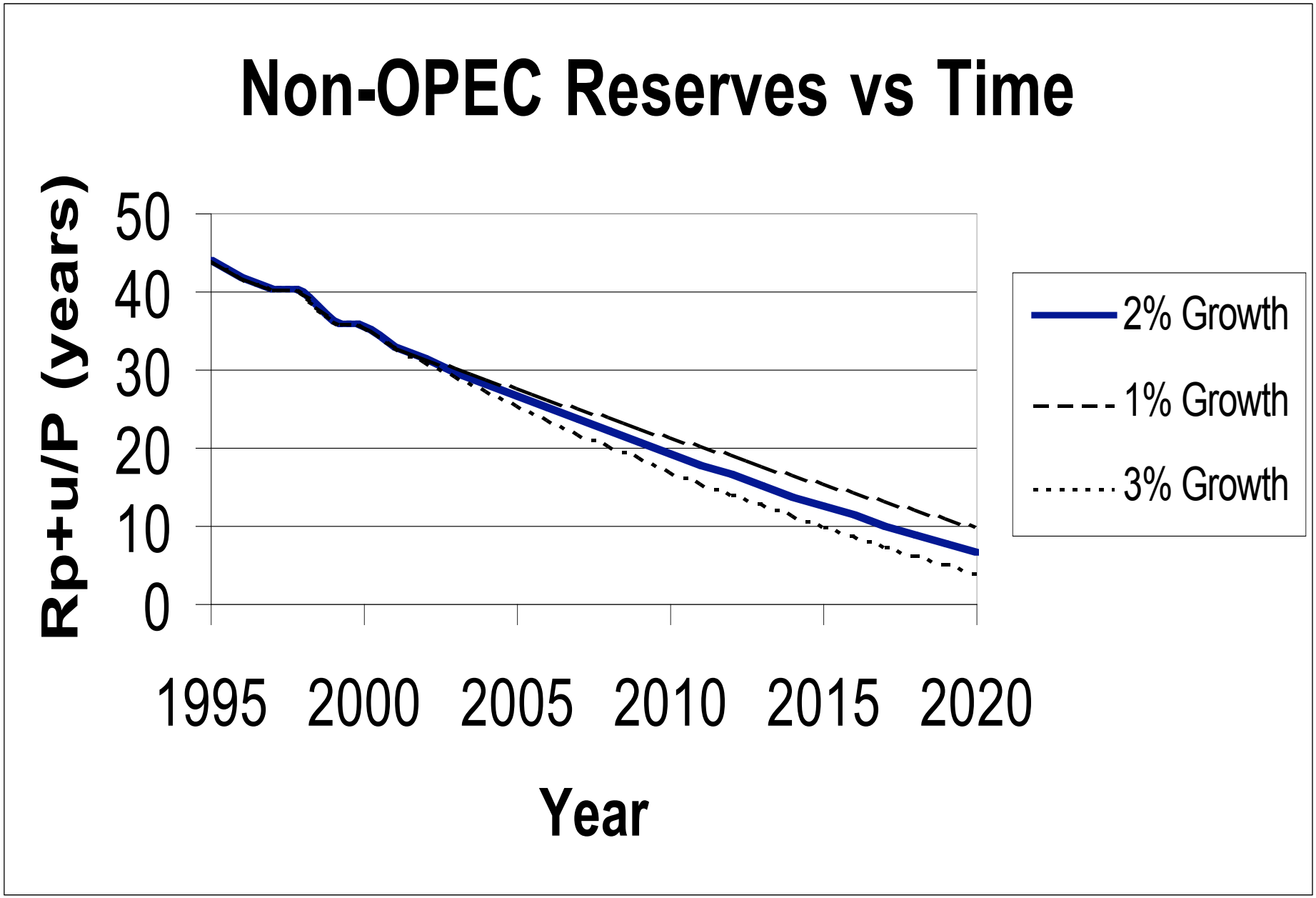
- Market Price gives no indication of how rapidly reserves are being depleted.
- Market rules favor maximum rates of current production (OPEC and non-OPEC).
- More expensive non-OPEC reserves are being depleted much faster than low cost OPEC reserves.
- Prices may decrease as production approaches a peak.

# THE MODEL

Model Assumptions:

- Market Stability: OPEC rules (swing producers)
- Decision Criterion: Production Plateau or Peak when USGS Proven plus Undiscovered Reserves to Production Ratio (Rp+u/P) drops to between 10 years and 20 years.

  (Economics: Nobody will increase production after this point since the future of the enterprise is threatened.)
- Aggregate/disaggregate reserves/producers
- Assume all undiscovered oil is discovered and marketed as rapidly as needed
- Assume 2% demand growth (1%, 3%).


Non-OPEC Reserves vs Time
Rp+u/P (years)
50
40
30
20
10
0
1995
2000
2005
2010
2015
2020
Year
2% Growth
1% Growth
3% Growth

# US Natural Gas

Large Resource, BUT

Resource Character Has Changed

Gas Well half life:

- 40 months (early 90s)
- 24 months (current)
- Market to be stabilized with massive LNG imports

# CONCLUSIONS

- Science (Reserve Estimates) plus Understanding of Market Rules allow credible predictions to be made
- Production peak in near future (2010-2020)
- Sooner under US, later under OPEC
- Cheap gas until the peak is clearly visible
- US-dictated production rates will lead to a much more chaotic transition to a sustainable economy.

* Alternatives are technically feasible and affordable