Global Petroleum Supply and Pricing: Is the World Really Running Out of Oil?

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Presentation Outline

- Introduction
  - Two Classic Schools of Thought Debate
    - Is the petroleum era about to end?
- Global Oil Resources and Supply Outlook
  - Reserve growth & capacity expansion
  - E&P industry performance Indicators
- Future Global Oil Supply and Pricing Outlook
  - What are the major determinants?
  - Understanding the role of the key players
- Concluding Remarks

Presentation Objectives

- Discuss the two schools of thought on the physical limit of petroleum availability.
- Analyze E&P industry performance indicators with respect to global supply sustainability
- Evaluate how global E&P key players influence petroleum supply & pricing outlook
- Demonstrate that the world is awash with oil and that it is conjectural to suggest otherwise in the nearest future.

Petroleum Resource Availability Fundamentals: ---The Underlying Issues in the debate are…

- Resources—the stock of oil deemed extractable in an undefined future.
- Reserves—resources presumed recoverable under currently known technology, operating, and economic conditions.
- Production capacity—a measure of the sustainable flow of petroleum as a result of discovery, investment, and infrastructures installed.

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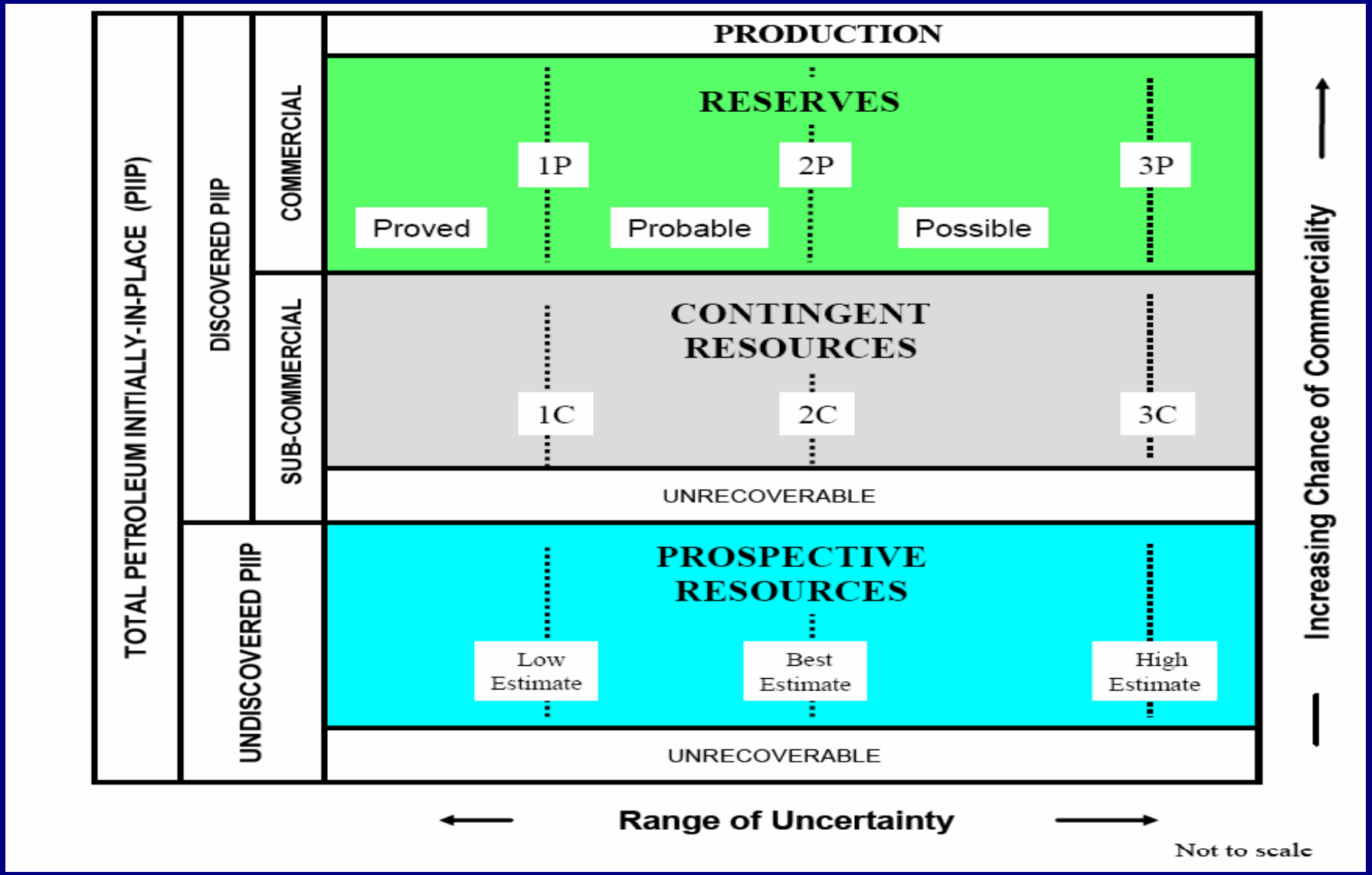
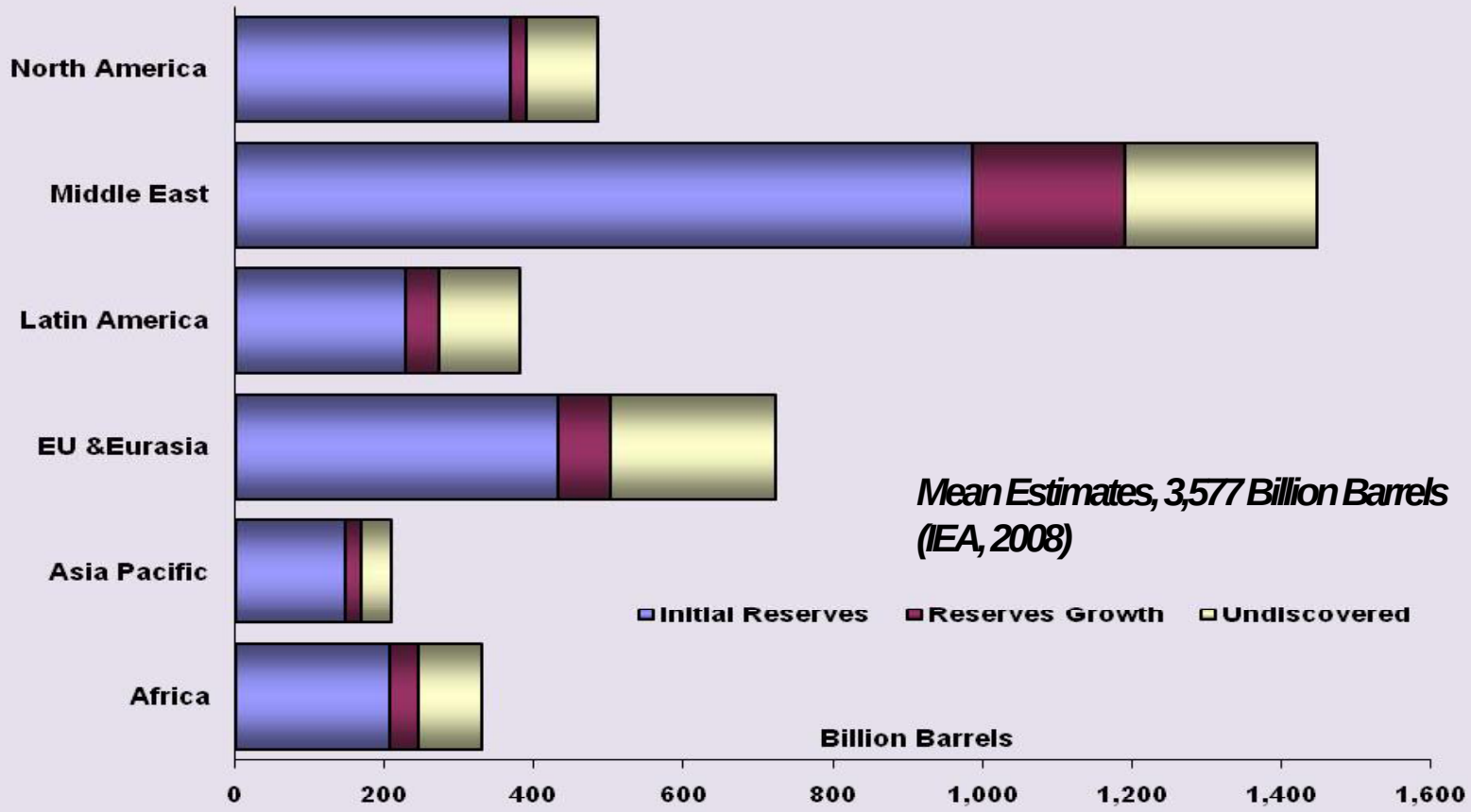
Schematic of Petroleum Resource Taxonomy

www.spe.org



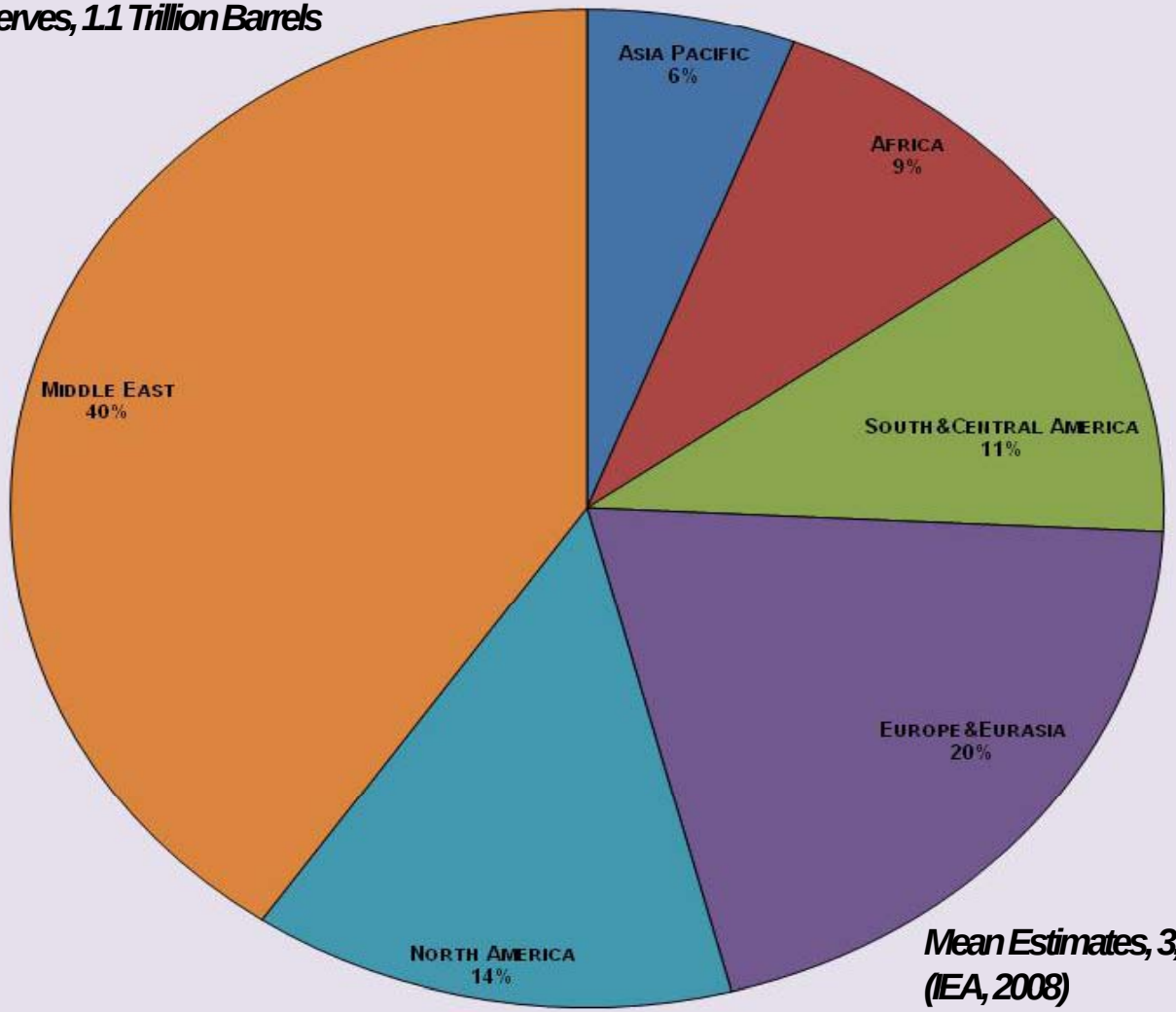
Conventional Oil Resources: Size & Locations



	Africa	Asia Pacific	EU &Eurasia	Latin America	Middle East	North America
Initial Reserves	206	147	433	229	986	368
Reserves Growth	40	22	70	44	204	22
Undiscovered	85	40	220	108	257	95

Conventional Oil Resources: Distribution by Geographic Region?

Above Ground Reserves, 1.1 Trillion Barrels



Mean Estimates, 3,577 Billion Barrels (IEA, 2008)

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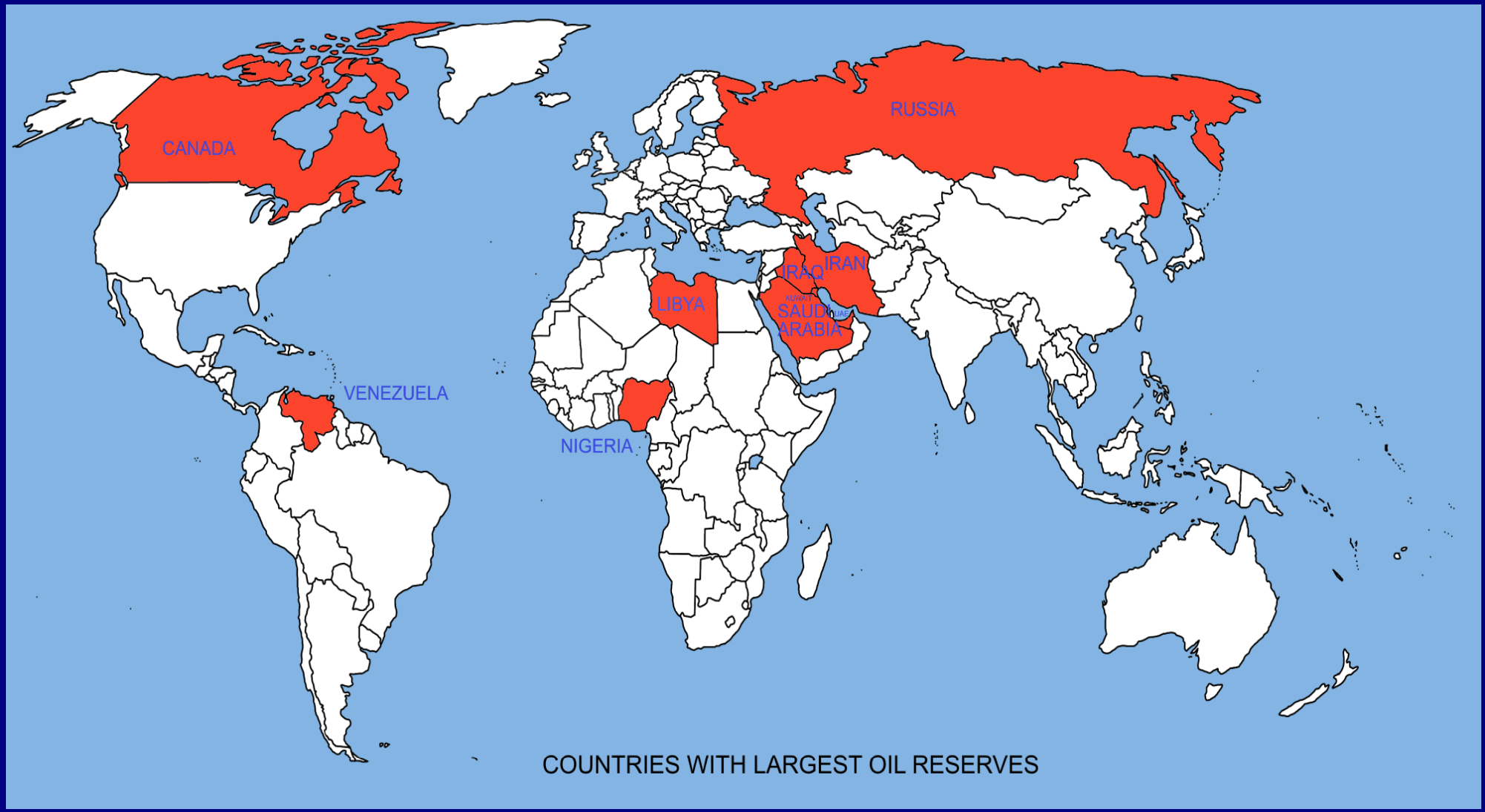
Conventional Oil Reserves: Countries with Largest Reserves (www.wikipedia.com)



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Conventional Oil Reserves: Top 10 Countries as of January 1, 2008

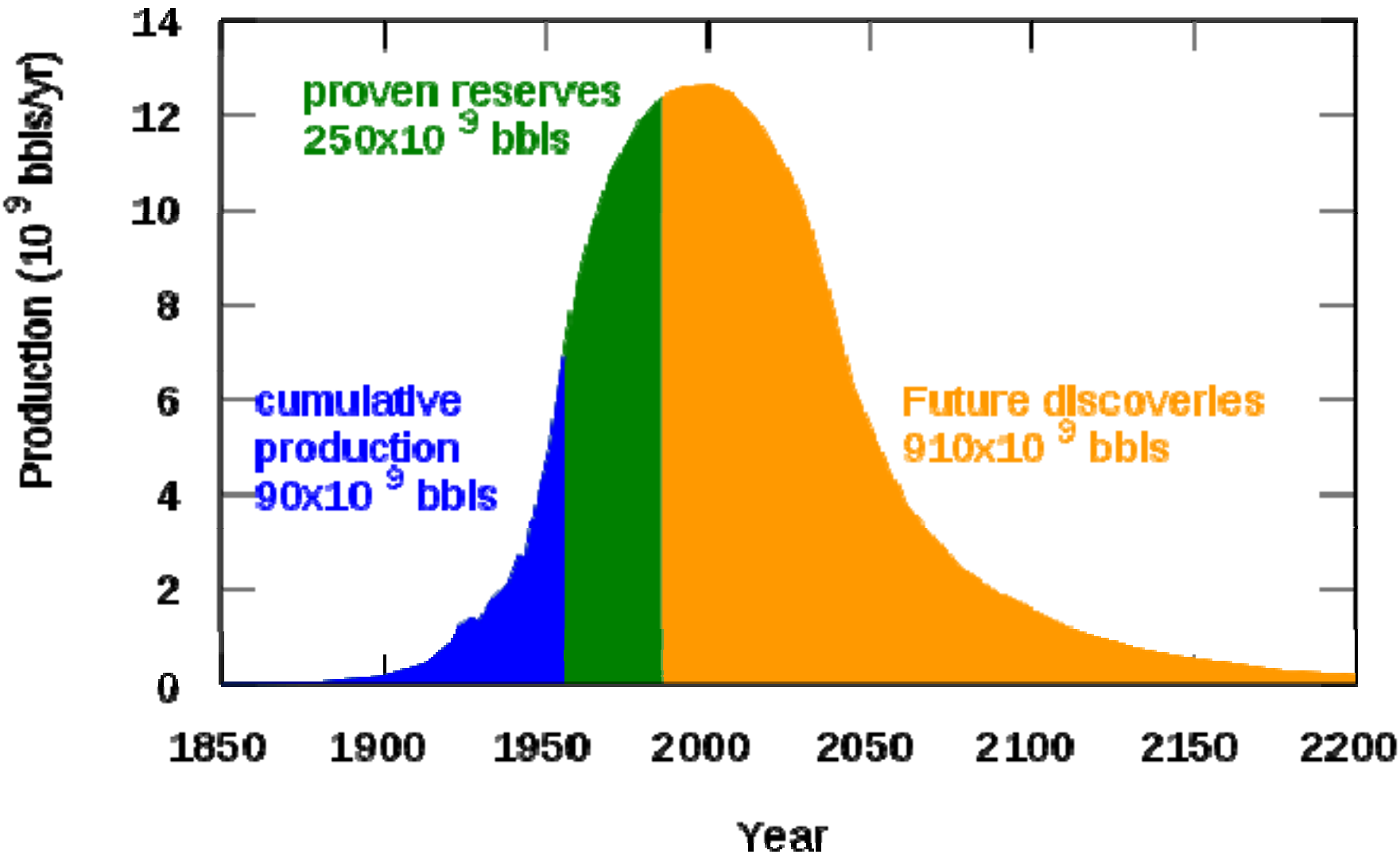
	Country	Reserves (bbl)	Share
--	United States	20,970,000,000	1.54%
1	Saudi Arabia	266,800,000,000	19.66%
2	Canada	178,600,000,000	13.16%
3	Iran	140,000,000,000+	10.20%
4	Iraq	115,000,000,000	8.47%
5	Kuwait	104,000,000,000	7.66%
6	United Arab Emirate	97,800,000,000	7.21%
7	Venezuela	87,040,000,000	6.41%
8	Russia	79,000,000,000	5.82%
9	Libya	41,460,000,000	3.05%
10	Nigeria	36,220,000,000	2.67%

Global Oil Resources and Supply Outlook:
Pessimistic School of Thought – There is a Wolf at the Door!

- Resources are fixed, capacity growth cannot meet future demand growth, and supply outlook is bleak.
  - Hubbert modeling framework (HMF) underlies the resource stock and flow pessimism.
- Global oil production has peaked or will peak soon and shortages are bound to occur.
  - The end of the era of petroleum as the driver of the global economy is in the nearest and not the distant future

Global Oil Resources and Supply Outlook:

Pessimistic School of Thought—Hubbert 1956 Original Model



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Global Oil Resources and Supply Outlook:

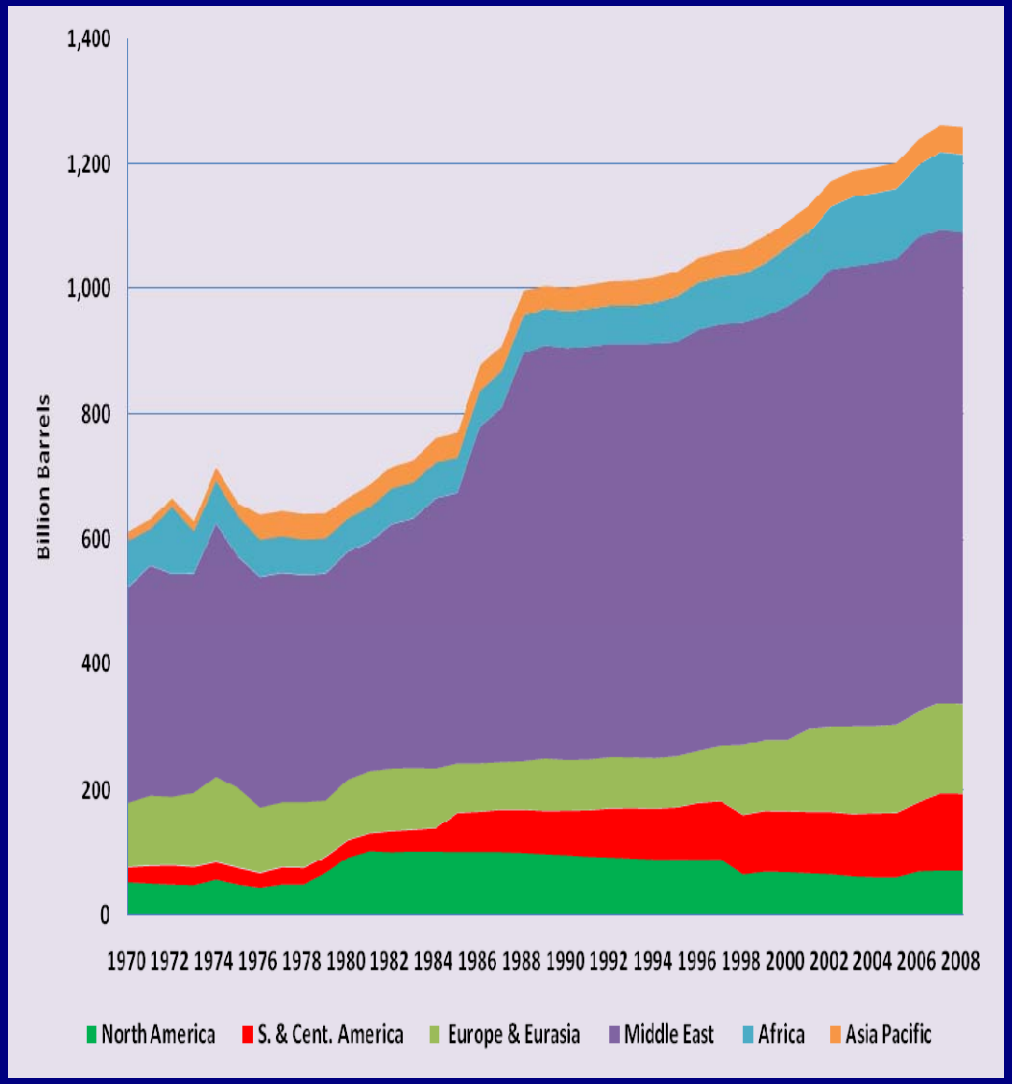
We have been told before that the end of the petroleum era is here!

Date of Forecast	Source	Forecast Date of Conventional Peak	Assumed Ultimate* Billion Barrels
1972	ESSO	"Oil to become increasingly scarce from about the year 2000."	2100
1972	Report for the UN Con. On Human Environment	"Likely that peak production will have been reached by the year 2000."	2500
1977	Hubbert	Peak: 1996	2000
1977	Ehrlich et al.	Peak: 2000	1900
1981	World Bank	"..plateau around the turn of the century."	1900
1995	Petroconsultants	Peak: 2005	1800
1997	Ivanhoe	Peak: 2010	~ 2000
1997	Edwards	Peak: 2020	2836
1998	IEA: WEO 1998	Peak: 2014	2300
1999	USGS (Magoon)	Peak: ~2010	~ 2000
1999	Campbell	Peak: ~2010	2000
2000	Bartlett	Peak: 2004, or 2019	2000, or 3000
2000	IEA: WEO 2000	Peak: "Beyond 2020."	3345 (from USGS)
2000	US EIA	Peak: 2016-2037	3003 (from USGS)
2001	Deffeyes	Peak: 2003-2008	~ 2000
2002	Smith	Peak: 2011-2016	2180
2002	'Nemesis'	Peak: 2004-2011	1950-2300

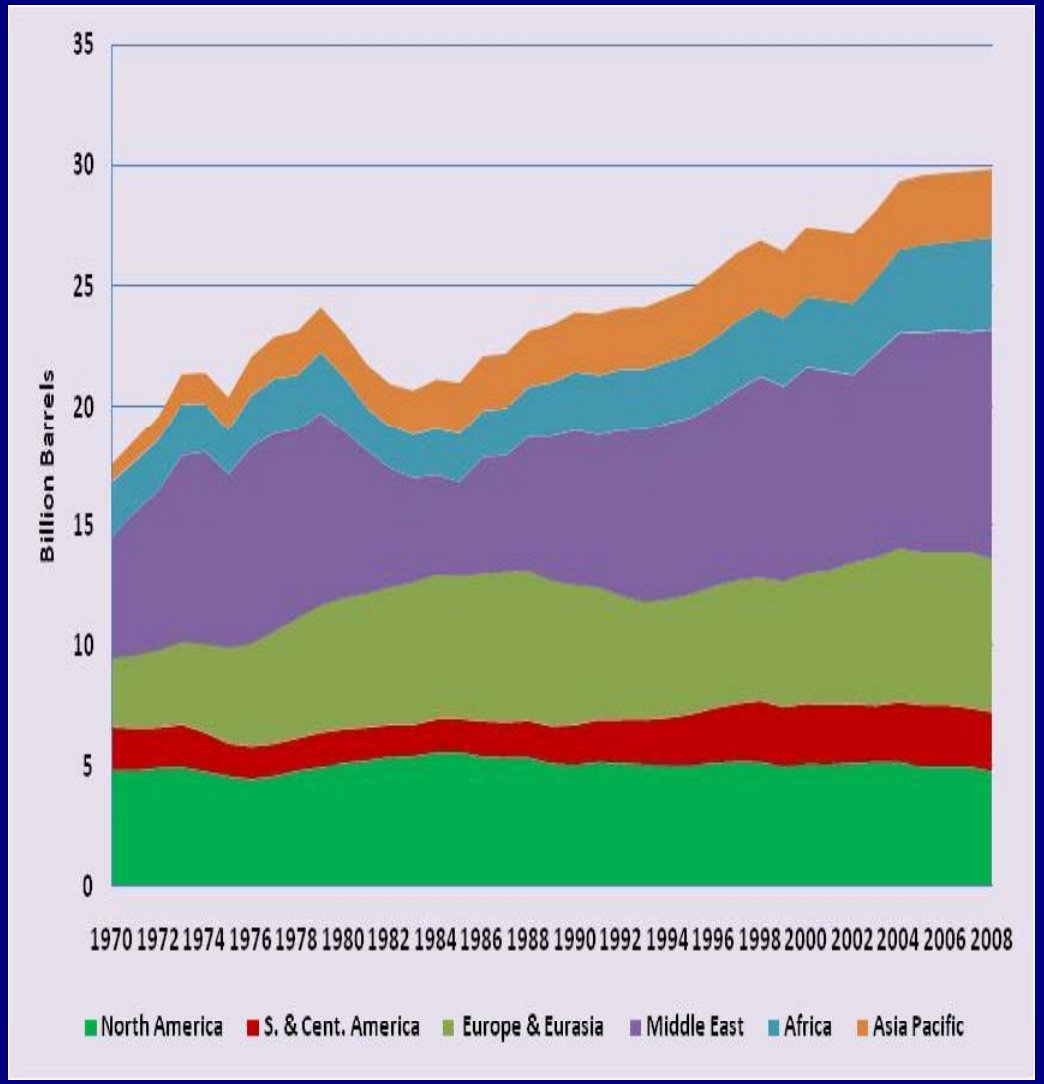
Source: www.oildepletion.org

Worldwide Reserves & Extraction - -Regional Trends: Evidence suggests, if there is a Wolf, it is not at the door … !

World Oil Reserves at Yearend



Annual World Oil Extraction



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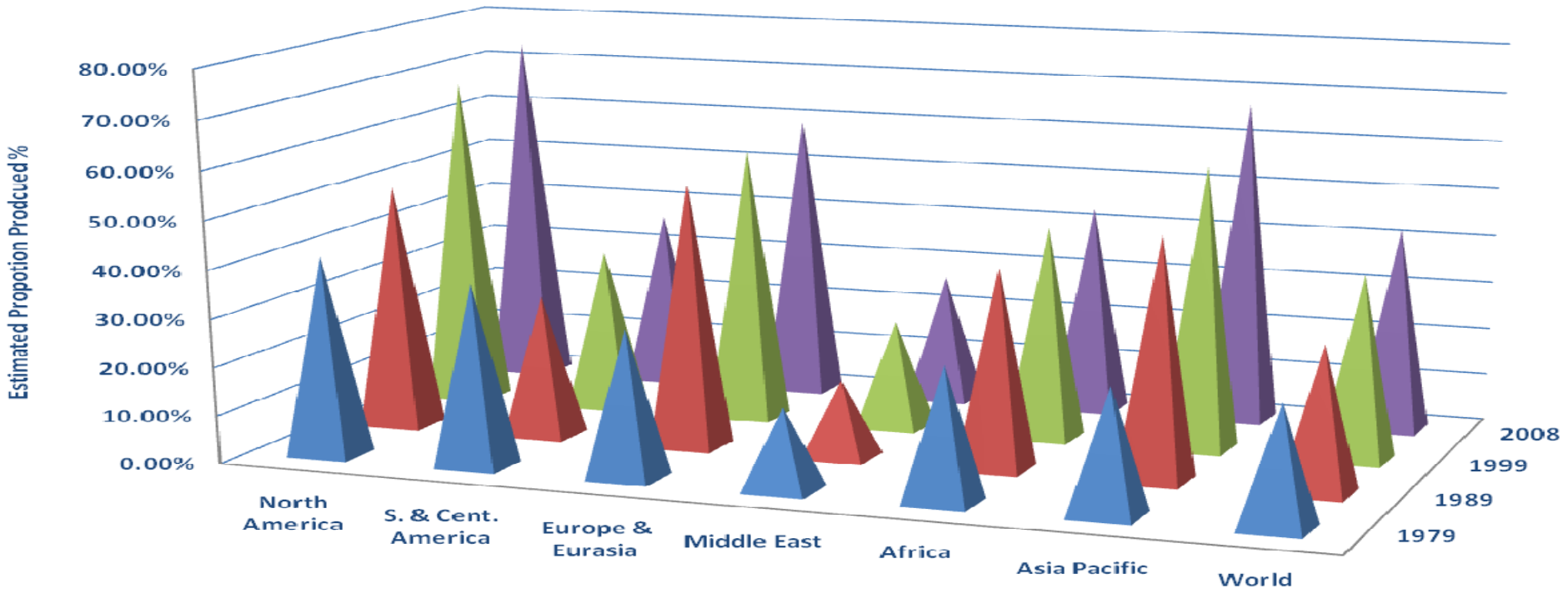
Proportion of Recoverable Reserves Extracted Since 1970: the end of petroleum era is no way near!

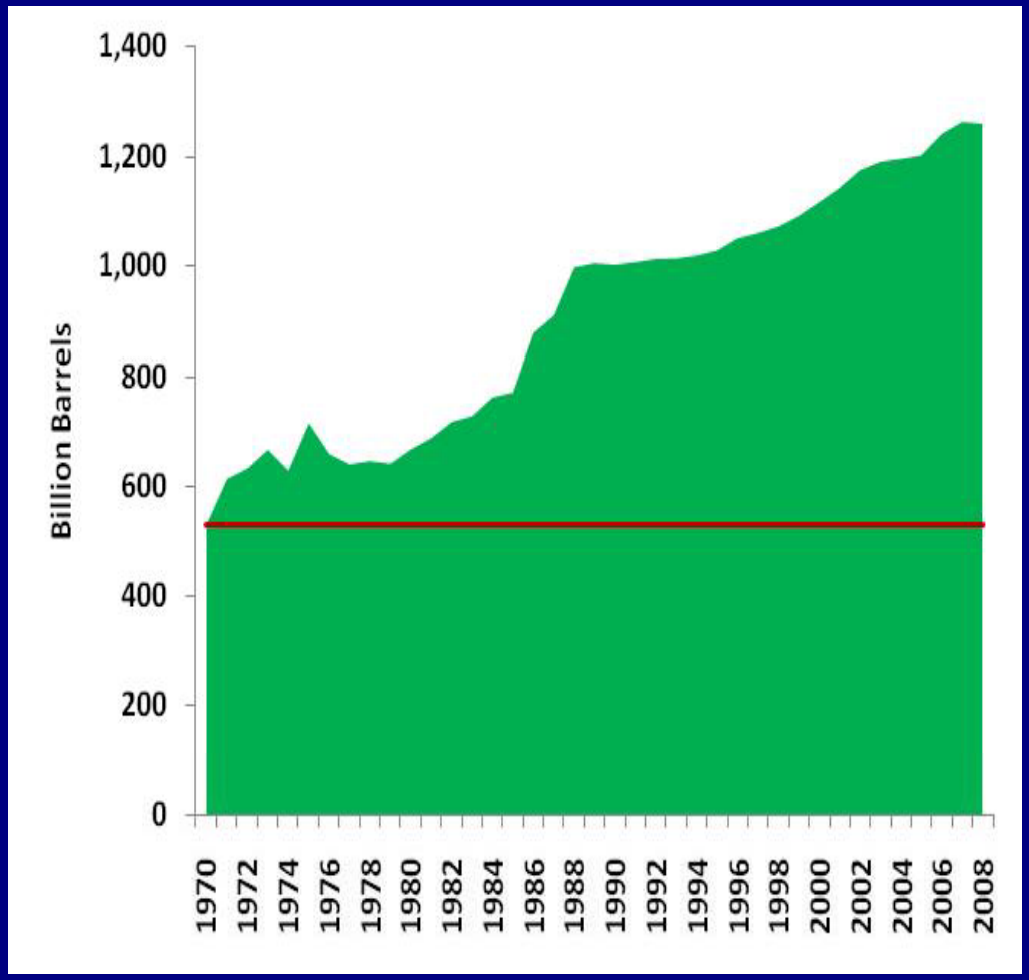


	North America	S. & Cent. America	Europe & Eurasia	Middle East	Africa	Asia Pacific	World
1979	41.30%	37.67%	30.51%	16.76%	27.54%	25.58%	24.73%
1989	50.87%	29.57%	54.49%	15.85%	41.28%	49.60%	30.00%
1999	68.68%	33.75%	57.27%	22.65%	44.48%	58.90%	38.45%
2008	73.60%	36.88%	59.34%	26.87%	43.77%	67.40%	42.74%

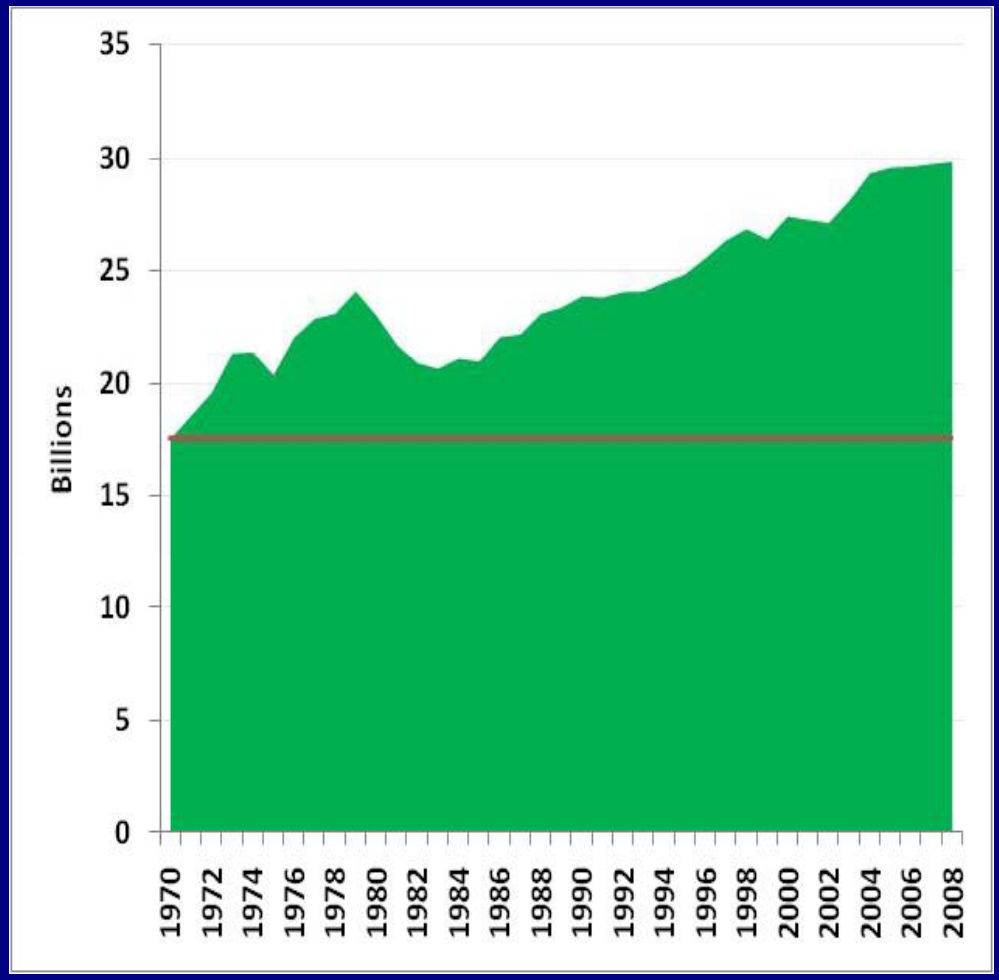
Global Oil Resources and Supply Outlook:

Trends since 1970 show reserves growth despite rising extraction…

World Oil Reserves, 1970-2008



World Oil Extraction, 1970-2008



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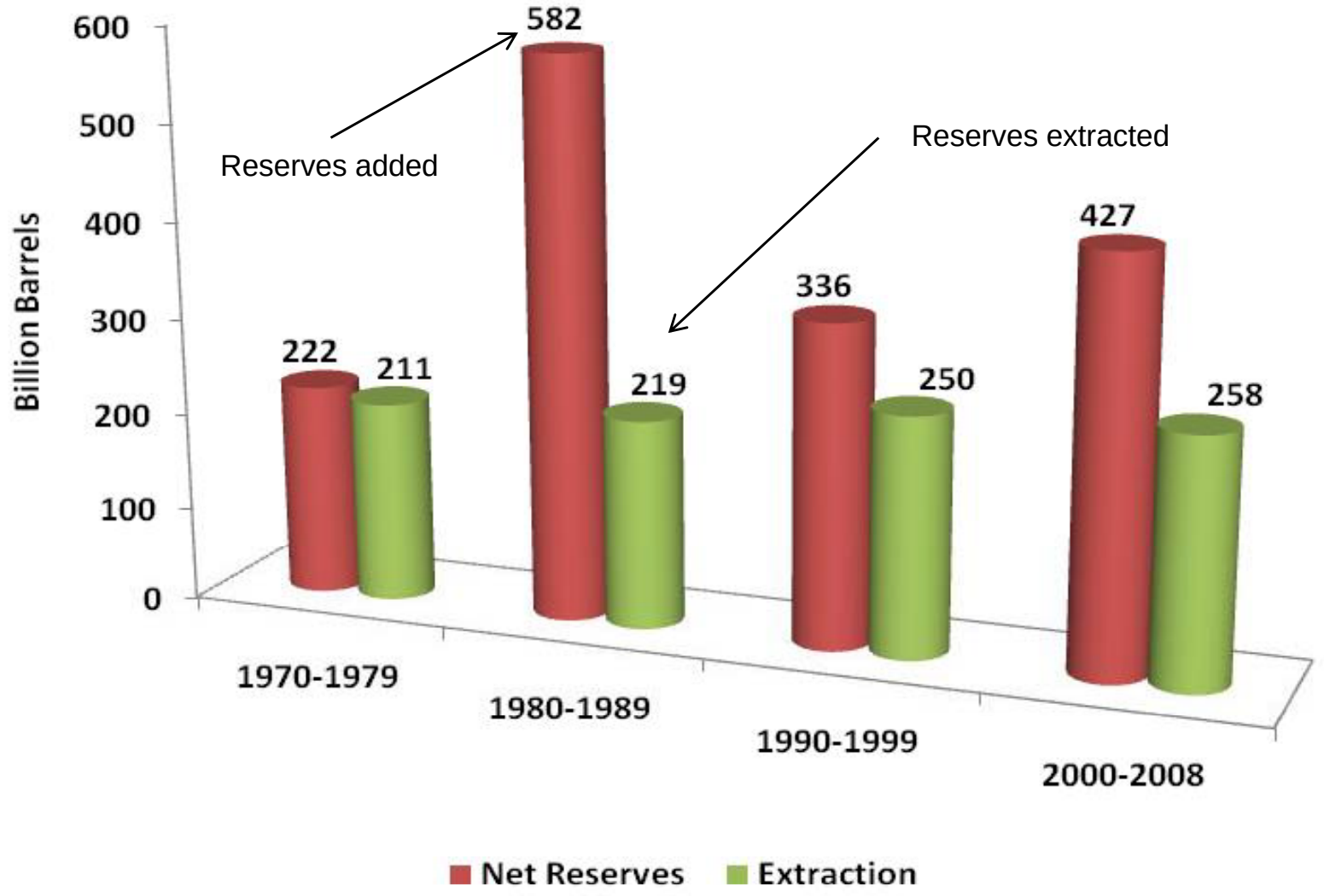
Global Oil Resources and Supply Outlook:
Optimistic School of Thought –Research & Development Matter

- Recoverable resource growth is assured but the extent of the size of growth may be imprecise.
- Technology does not just hasten or enhance extraction from existing resources but it equally facilitates growth in reserves.
- Economics and fiscal policy do affect resource discovery and production, just as geology does.
- HMF though statistically robust for describing the U.S. pre Alaska peak in the 1970s, is not significantly scientific to explain the global depletion process completely.

Periodic Worldwide Reserves Added & Extracted: More Reserves Added than Extracted Since 1970



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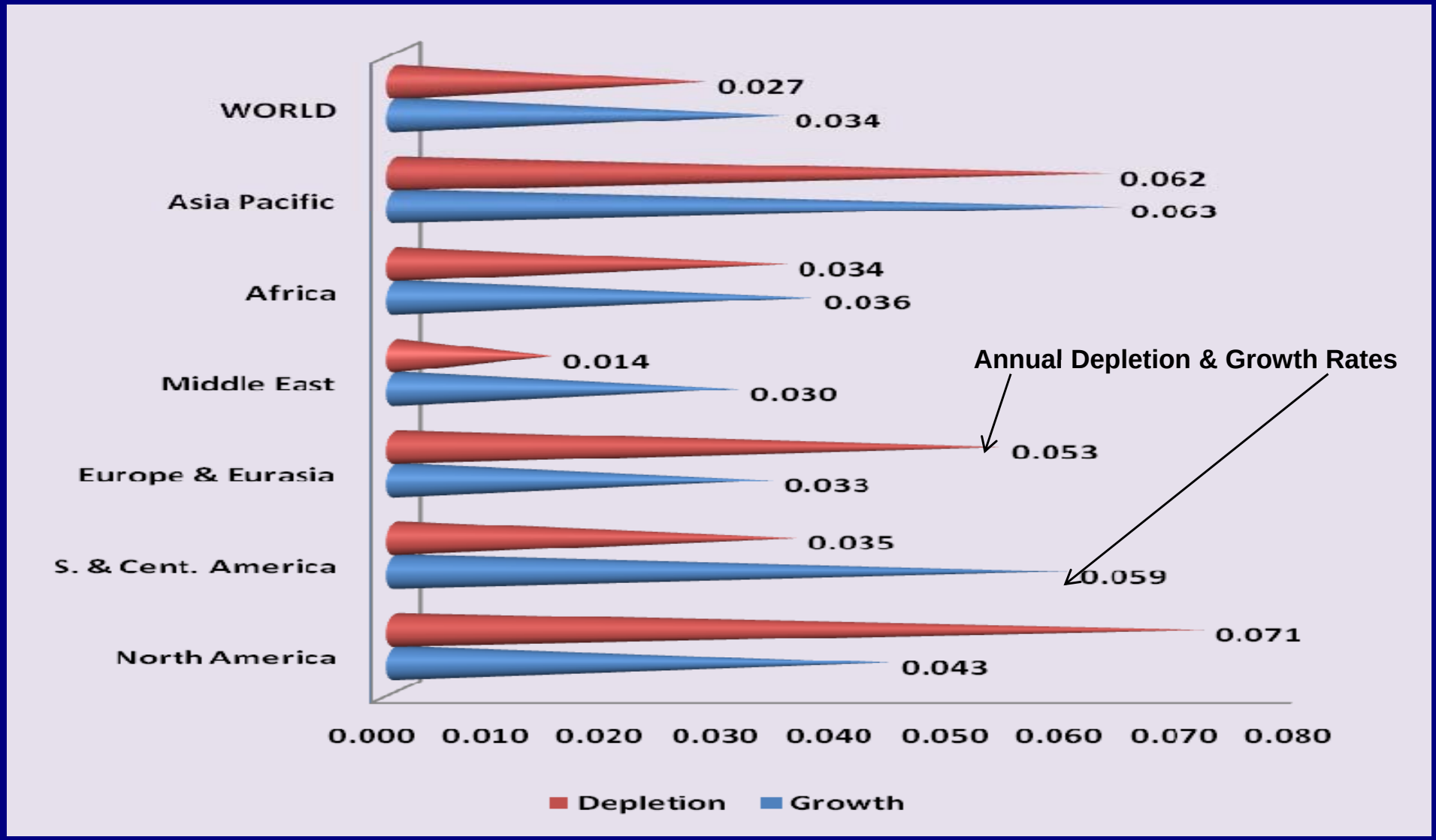
Global Oil Resources and Supply Outlook:

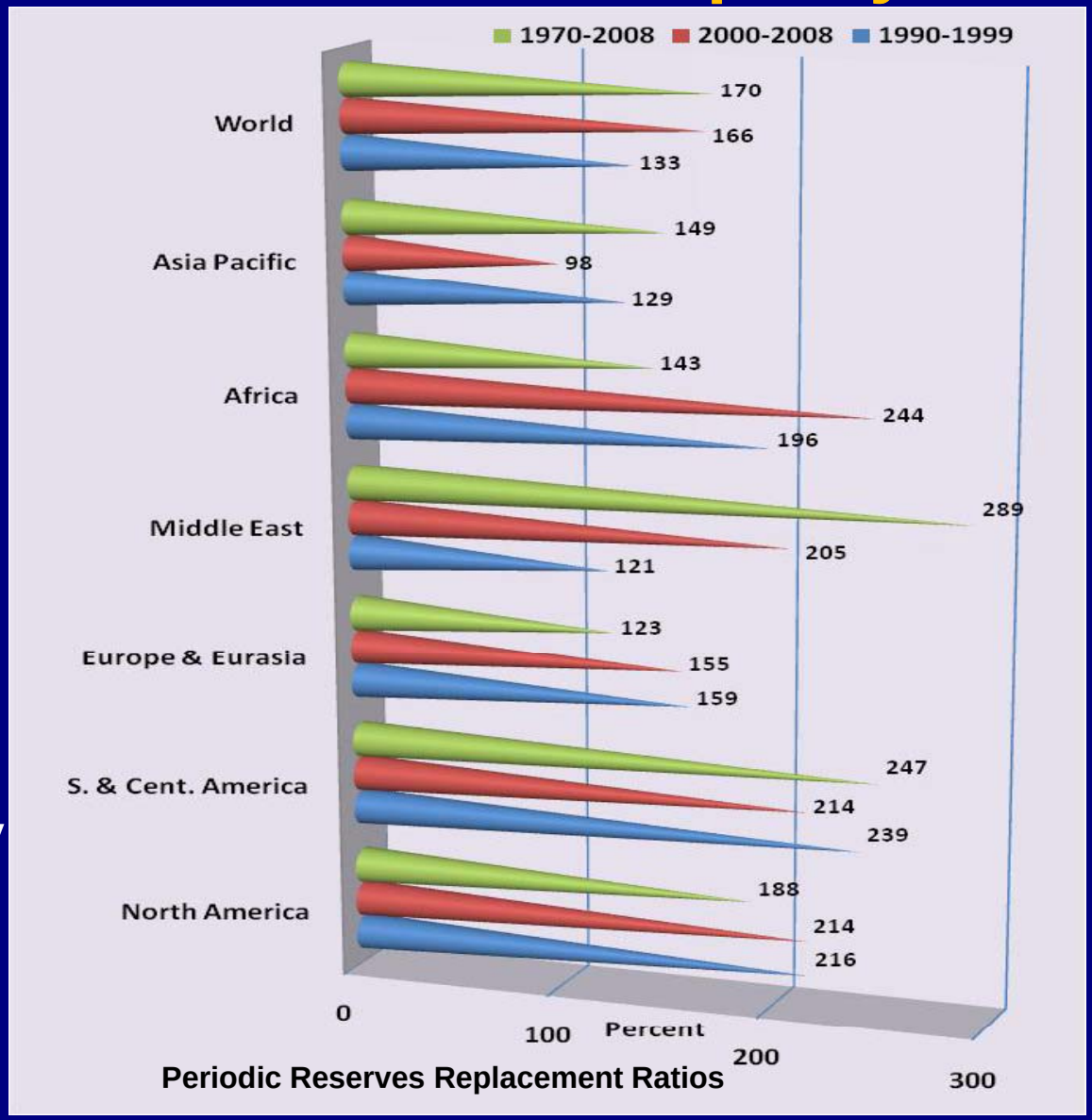
Is depletion since 1970 faster than expansion…?



Global Oil Resources and Supply Outlook:

Is the World Replacing Extracted Reserves Adequately ?

- High replacement rate delays imminent exhaustion of petroleum resources.
- Reflects the robust state of the global exploration and production (E&P) business.
- Supports sustainability of E&P business in several producing regions.



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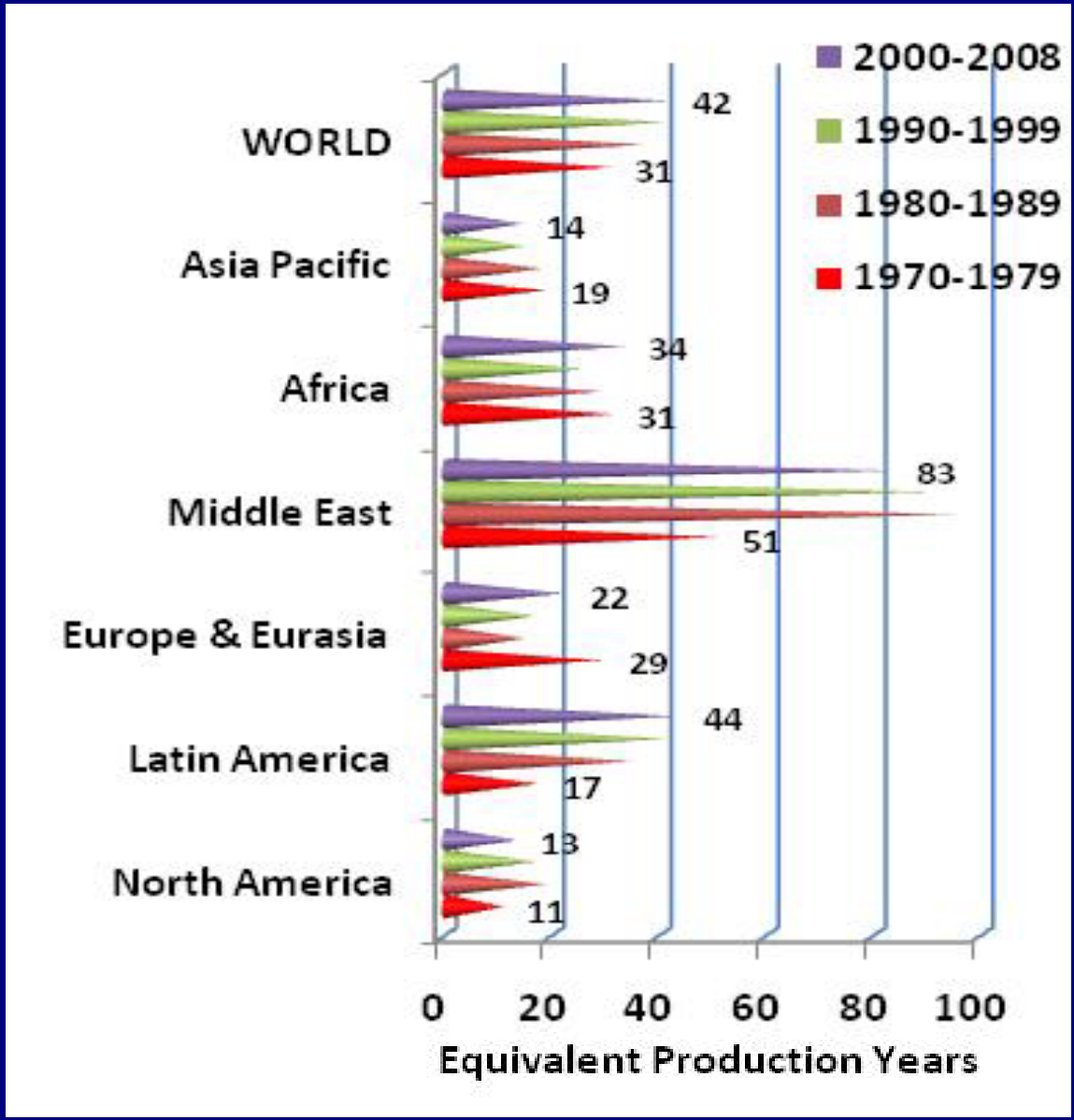
Global Oil Resources and Supply Outlook:

Is Estimated Proved Reserves Adequate to Sustain Projected Demand Growth ?

- Periodic Reserves-production (R-P) ratio:
  - Shows less tightness in oil market over space and time.
  - But, is a low R-P preferred to a high R-P?
- Global average R-P was above 30 years in the 1970s.
  - It's above 40 years currently.



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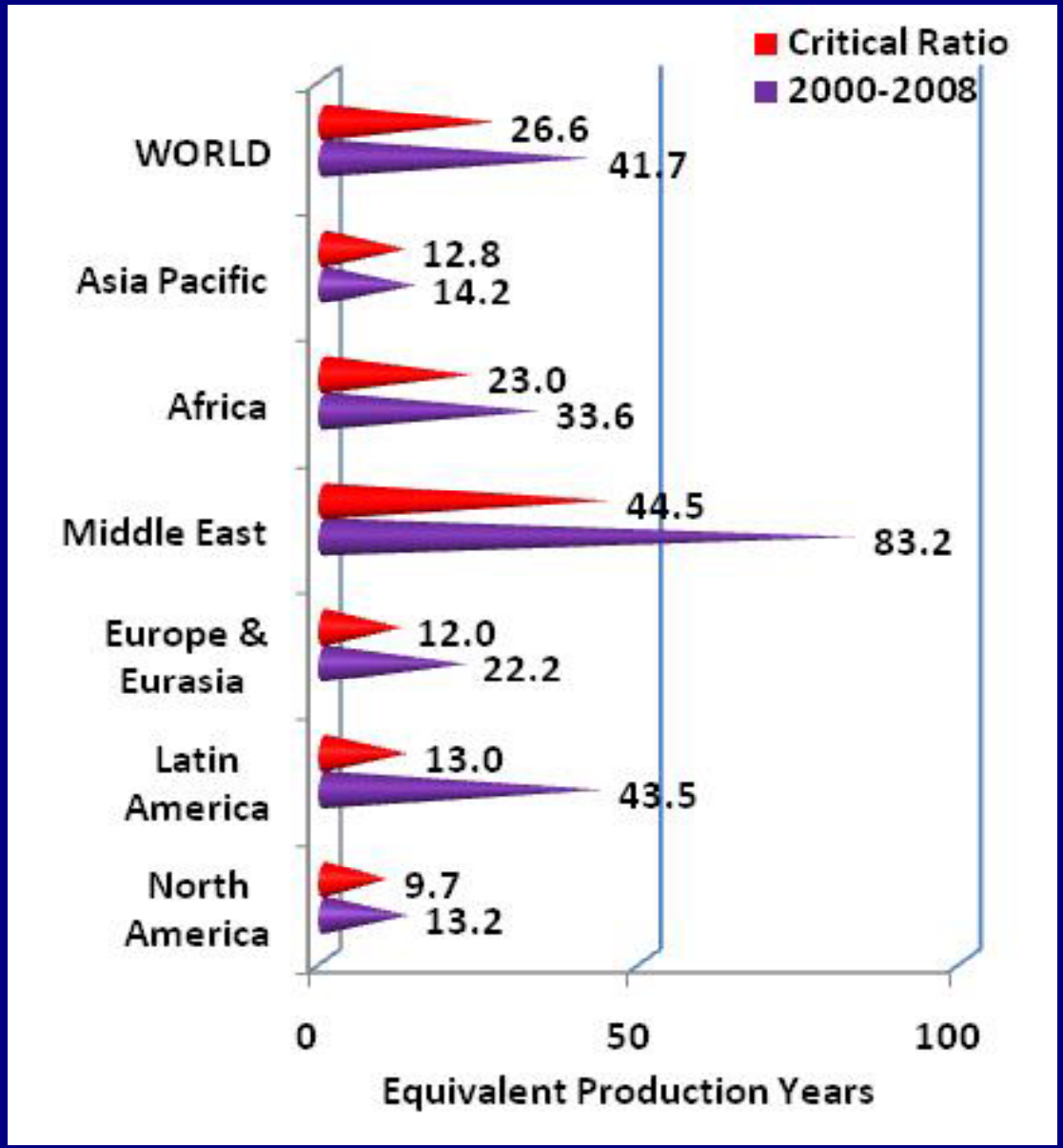
Global Oil Resources and Supply Outlook:

Is Estimated Proved Reserves Adequate to Sustain Projected Demand Growth?

- Critical R-P reflects historical minimum value between 1970 and 2008.
- R-P shows verifiable sustainability of reserves at moderate growth in extraction rate.
- Worldwide sustainability premium is about 15 years in comparison to the 1970s.



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Future Global Oil Supply & Pricing Outlook: The Role of the Market Systems

- Physical market fundamentals:
  - Non OPEC supply responsiveness
  - Energy demand in the emerging economies
  - Access to petroleum resources
  - Investment constraints
  - Technological innovation..
- Paper market conduct:
  - Exploitation of oil market volatility by commodity traders.
  - The laws of unintended consequences.

Future Global Oil Supply & Pricing: Role of Research & Development

- Technology facilitates generational equity issues.
- Reserve growth and production enhancement.
- Limits rapid increase in price growth at lower than the rate of interest.
  - Finding and development costs are expected to decrease, *ceteris paribus.*
  - The rate of increase in marginal extraction cost will fall and hence price falls, *ceteris paribus*

Future Global Oil Supply & Pricing: Role of International Oil Companies (IOCs)

- Return on investments: is long-run preferred to short-run?
- Restructuring mood to promote efficiency, but must keep in perspective equity, effectiveness, and ethical issues.
- Grow inventories of oil reserves to sustain business outlook.
- Curtail finding costs drifting upward through discovery surprises and technical progress .
- Direct E&P investment flow to where resources are abundantly located with significant cost advantage.
  - Inevitability of IOC, OFS & NOC partnership.

Future Global Oil Supply & Pricing: Role of Developed and Oil Importing Nations

- Diversification of supply sources and strategic petroleum reserves/inventory as a policy strategy
- Energy policy objectives to promote easy access to cheap, clean and secure energy worldwide.
- Lift the ban or restricted access to resources to minimize supply uncertainty and hence global oil pricing.
- Make environmental policies pragmatic and keep in perspective any unintended consequences of barrier to access available petroleum resources.

Future Global Oil Supply & Pricing: the Role of OPEC & National Oil Companies (NOCs)

- OPEC's objective to maximize the intergenerational social well being of their citizens will influence global oil supply decisions.
- Rate of reinvestment in production capacity and level of spare capacity are important features to watch.
- Depletion policies in OPEC countries extremely critical to investment flows.
- IOC, OFS, & NOC partnership is inevitable for market stability.
  - IOC & OFS own E&P technology, significant access to funds, and experience.
  - NOCs have ownership of significant resources but limited technology and access to skilled workers and funding.

Summary and Conclusions

- The idea of a geologically induced end to the petroleum era worldwide is not about to happen.
  - Over 150 percent of worldwide produced conventional oil reserves was replaced over the last 38 years in the aggregate.
  - Global reserves production ratio remains above 35 years over the last 25+ years despite extraction growth.
  - There is a premium of about 15 years over where the global petroleum status was in 1970.
- The conventional wisdom is that technology has not peaked and the intelligence of human mind remains astounding.
- The path to IOC, NOC and OFS partnership is less fuzzy than in the past, making the imminent end to the petroleum era quite nebulous.

Summary and Conclusions

- Perhaps, we may be running out of subsidized petroleum not because of geological exhaustibility but:
  - Restricted easy access to global petroleum resources.
  - Limited capital investment flow to resource rich nations because of uncertainty and insecurity of investment.
  - E&P industry restructuring driven possibly by short term planning horizon and performance priority.
  - The “law of unintended consequences” that tends to make the call for transparency in crude commodity market trading, touchy!

Global Petroleum Supply and Pricing: Is the World Really Running Out of Oil?

Thank you for your Attention!

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