



Centre for Energy and
Environmental Markets

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International Oil Prices

Drivers and Outlook

Presentation by Anthony D Owen
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Crying wolf (again!) or has the wolf arrived at the door?

“Oil is far too cheap at the moment.” The figure I’d use is around \$182 a barrel. We need to price oil realistically to control its demand. That is because global production is peaking”. “If we price oil correctly, it could give us time to find bridge fuels, fuels to fill the gap between an oil economy and a renewable economy. But I don’t see that happening” (June 2004).

Matt Simmons, energy investment banker and an adviser to the controversial Bush energy plan



Peak oil argument

- Most of the world's oil has already been found as evidenced by the lack of recent giant discoveries;
- Middle East reserves have been over-stated for political reasons;
- Existing ME fields will not expand in size and production; and
- Most producing countries outside of the ME are near, if not past, their point of peak production.



Oil production must inevitably peak, but will this develop through a lack of demand or as a resource constraint?





Problems with “peak oil” methodology

- Static: completely supply-side driven;
- Lack of reliable reserve and endowment data;
- Ignores many non-conventional reserves;
- Ignores technological advances in oil recovery.



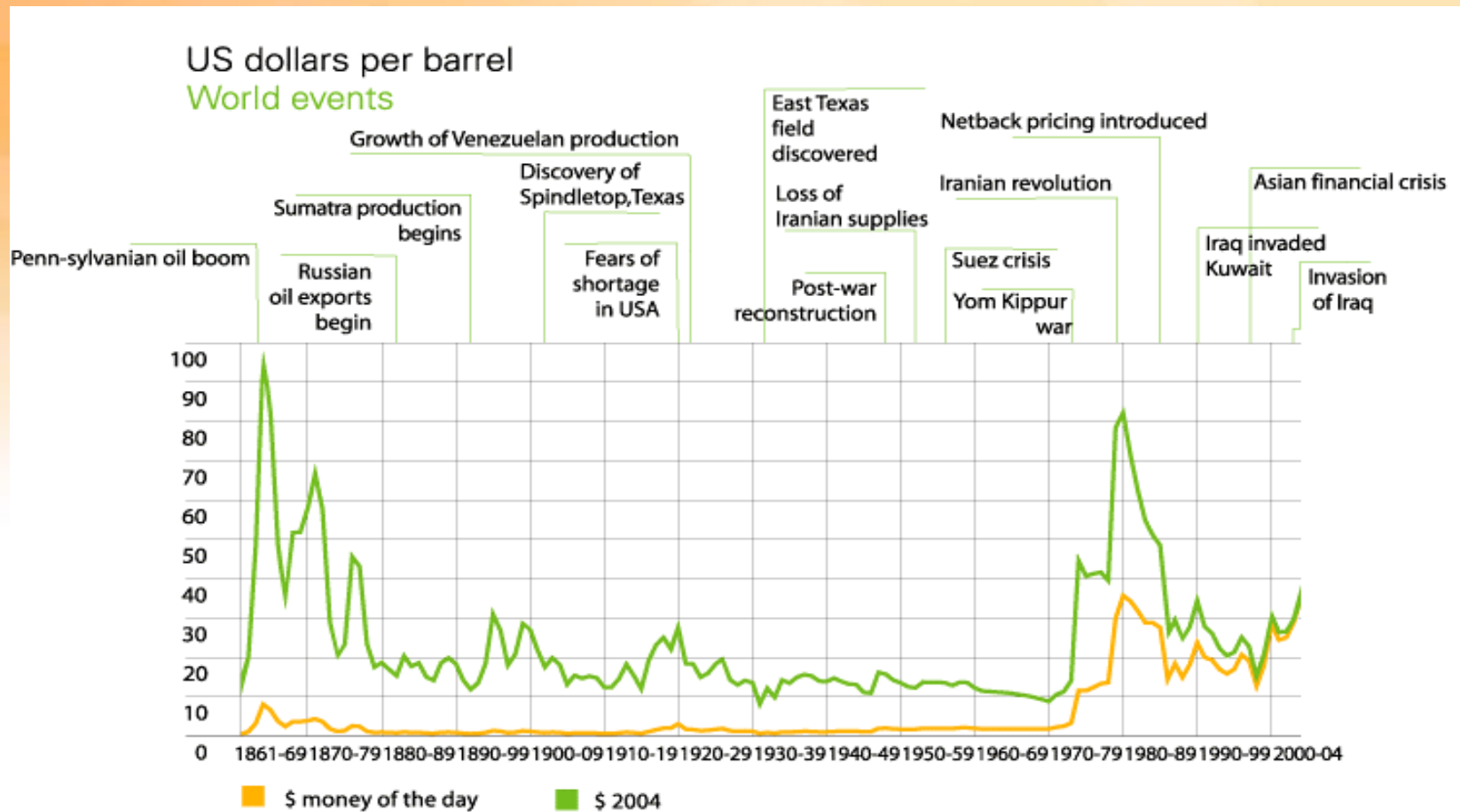
Projected demand

- Consumption (2004): 30 billion barrels
- IEA projected growth to 2030: 1.6% p.a.
or about 1 trillion barrels cumulative.

Cumulative production to date:
about 1 trillion barrels



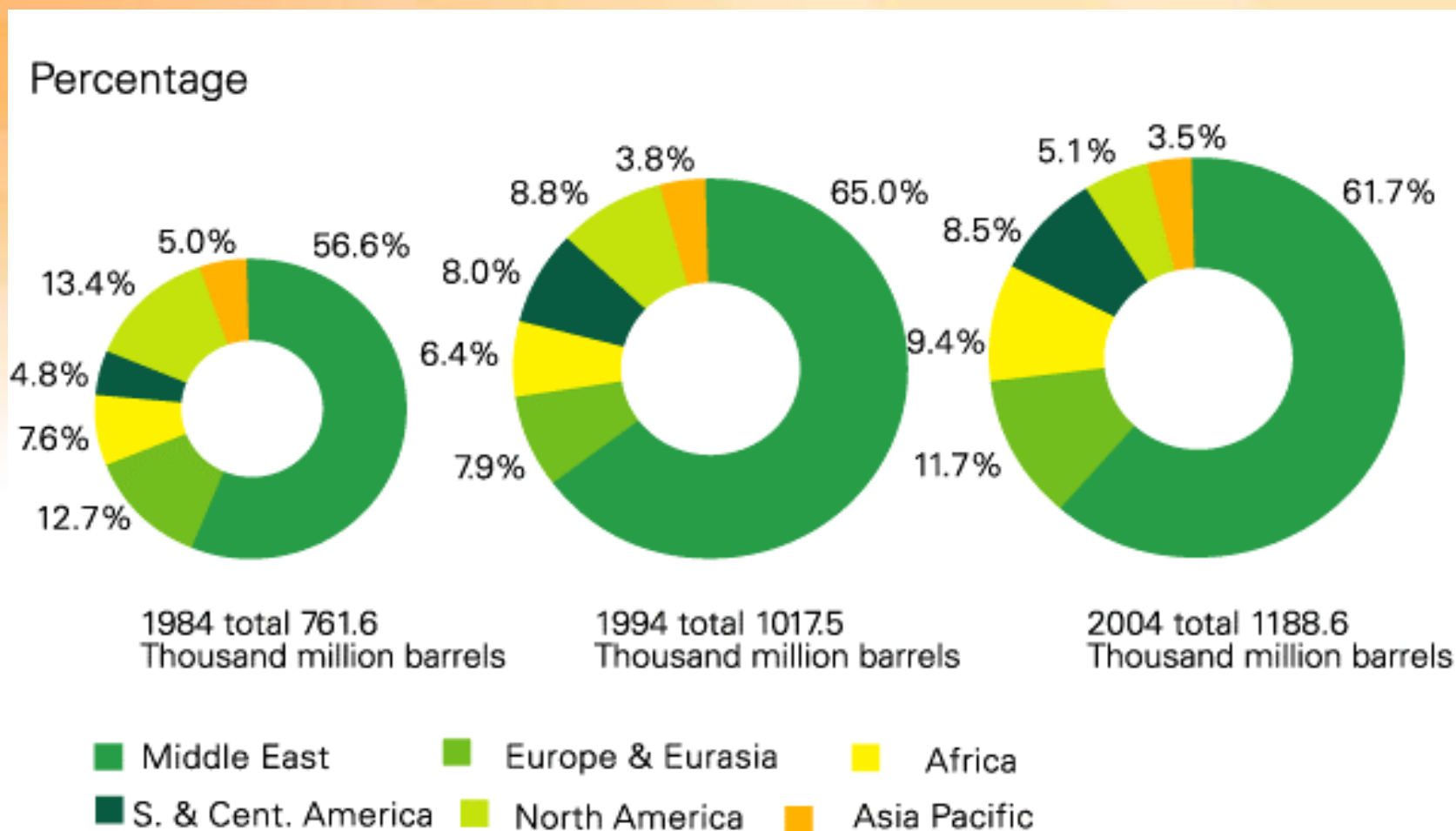
Crude oil prices since 1861 (Source: BP)



1861-1944 US average.
1945-1983 Arabian Light posted at Ras Tanura.
1984-2004 Brent dated.

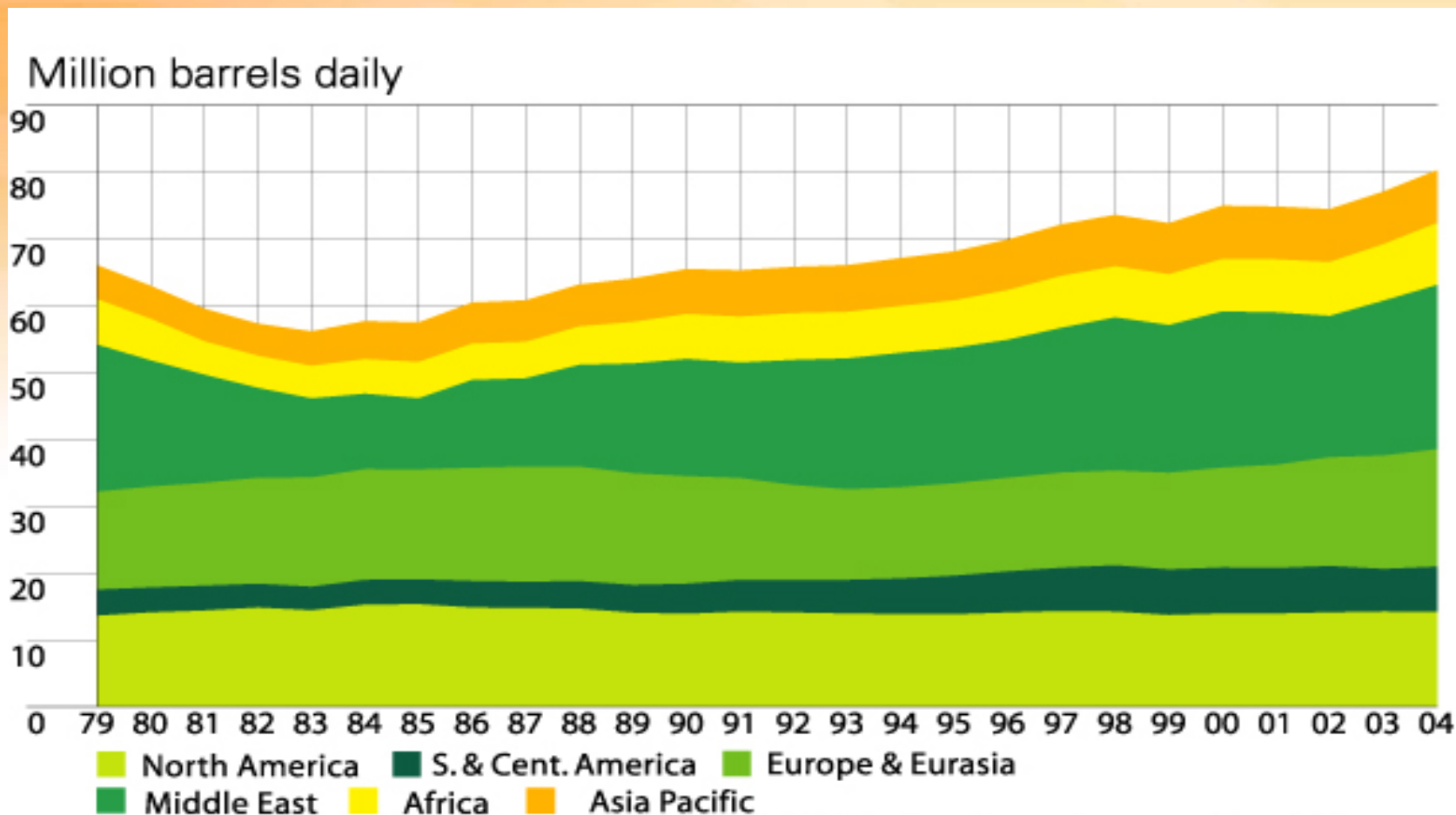


Distribution of proved oil reserves (Source: BP)





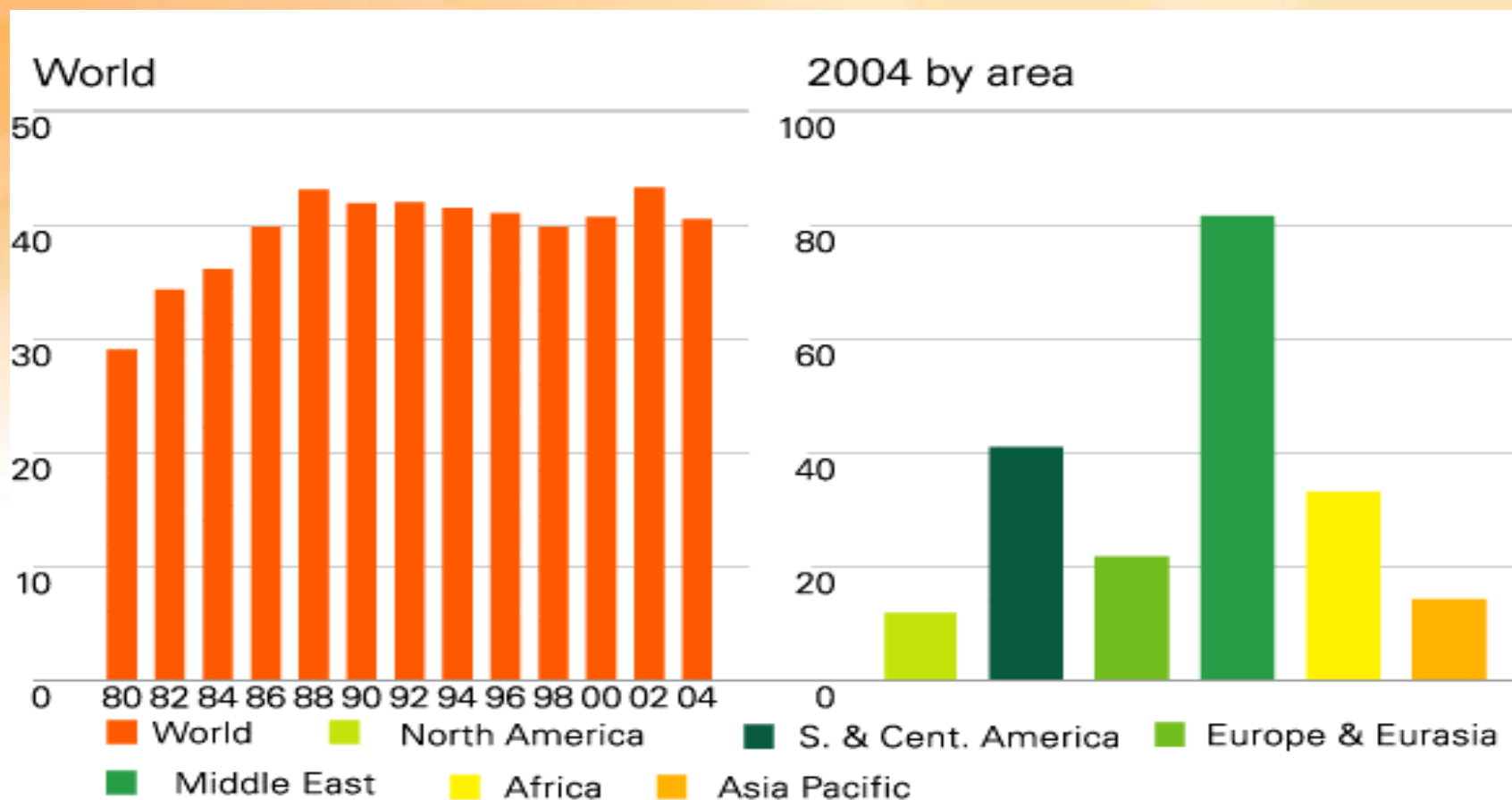
Oil production by area (Source: BP)



Oil production rose by more than 3 million b/d in 2004, the largest increase since 1976.
OPEC output rose by more than 2 million b/d; Russian output also grew strongly.



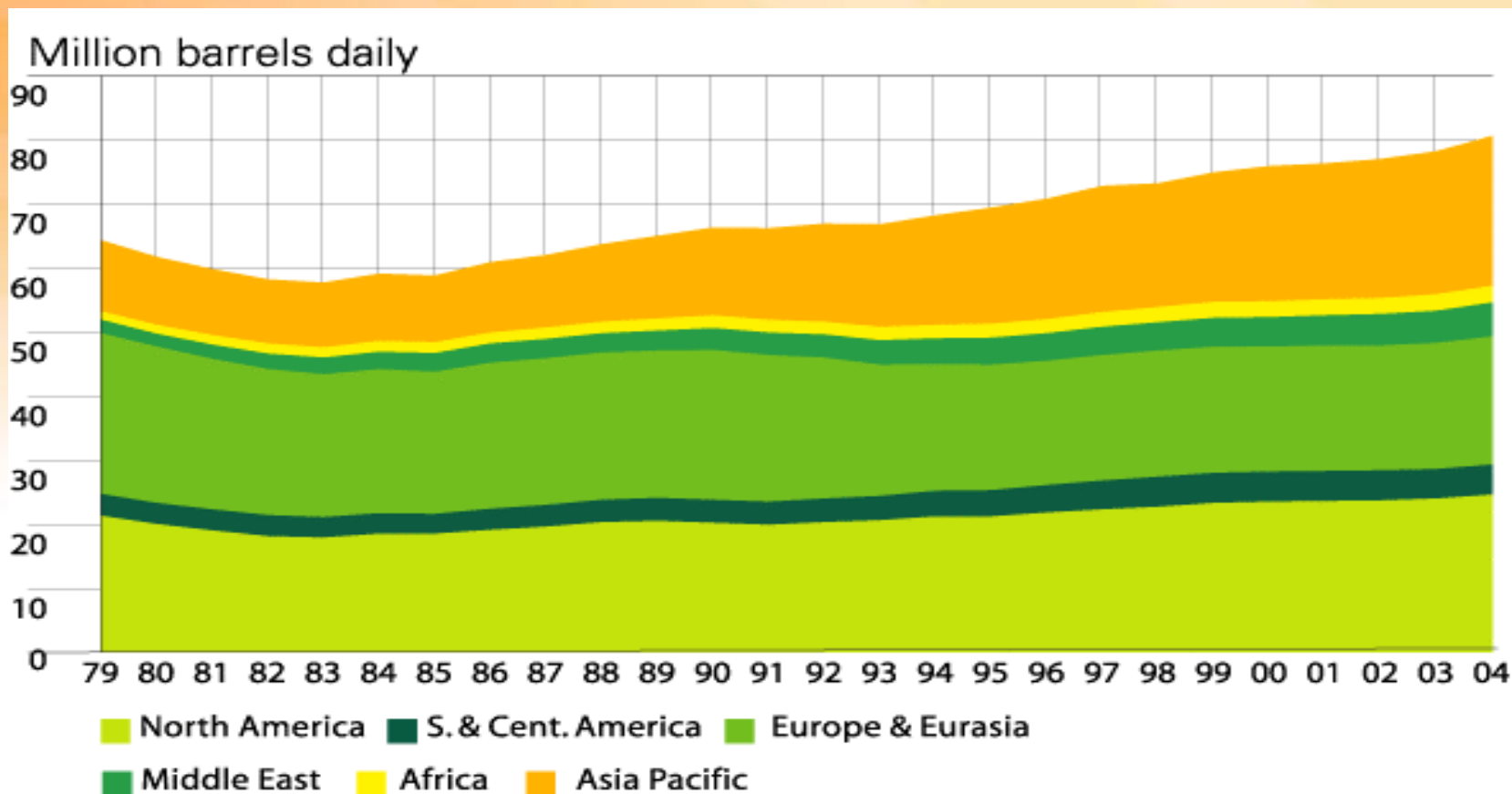
Oil reserves to production ratios (Source: BP)



The world's oil reserves-to-production ratio fell to 40.5 years in 2004, down from 43.3 in 2002. Reserves have continued to increase and now stand 17% above the 1994 level; production is 20% higher.



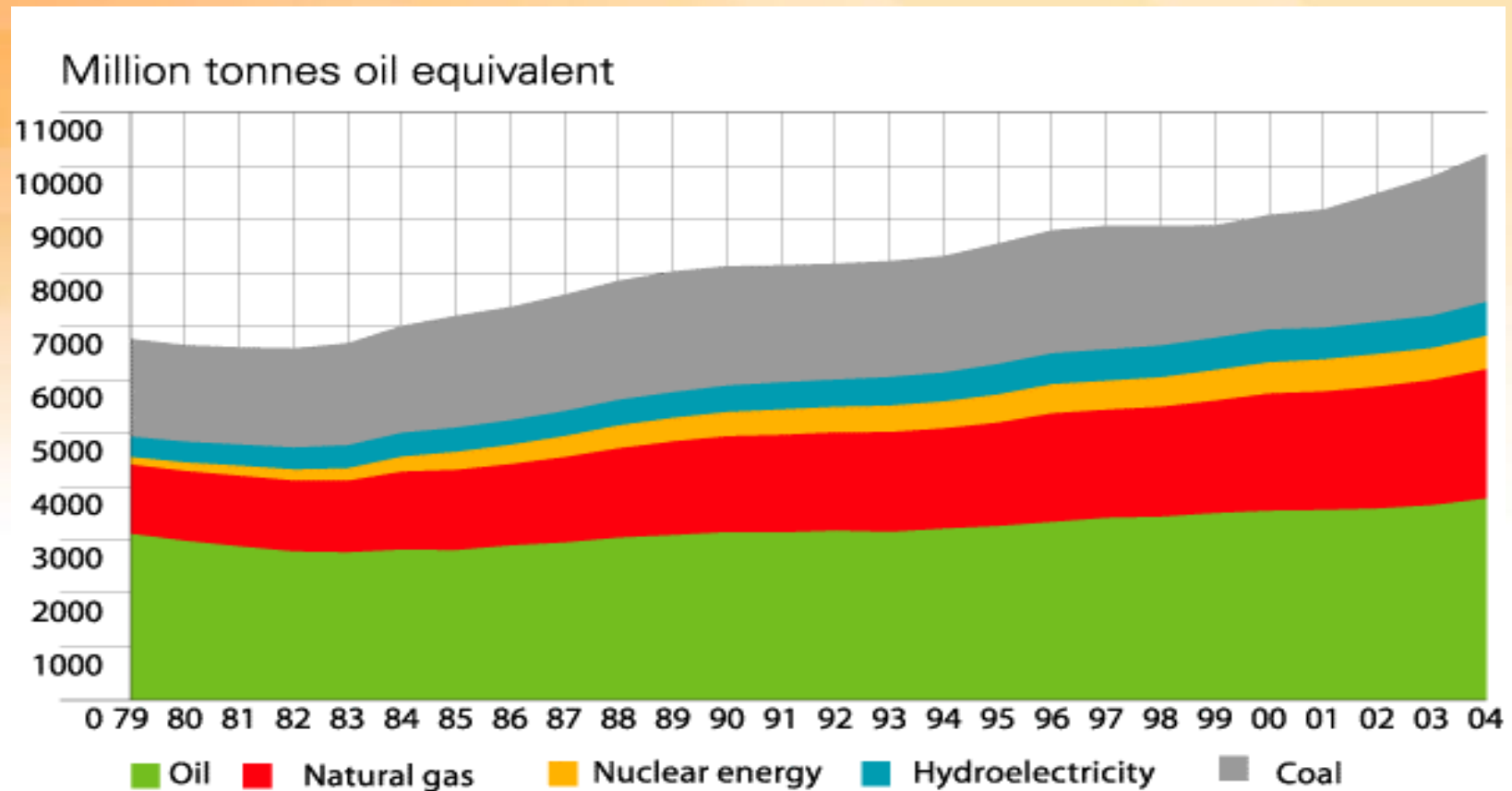
Oil consumption by area (Source: BP)



The rate of world oil consumption growth was the strongest since 1978. Growth was above the 10-year average in every region. Asia Pacific has accounted for 50% of global growth over the past decade.



World primary energy consumption (Source: BP)



Global primary energy consumption recorded the strongest incremental growth ever, rising by 4.3%. Growth was above the 10-year average in all regions and for all fuels.



Major problems: ignorance & uncertainty

- Over-reliance on Saudi Arabian production
- Saudi Aramco, Saudi Arabia's state-owned oil company, has not provided production data for more than two decades!
- Last verified proven Saudi reserve assessment was in 1979
- $\frac{3}{4}$ of incremental demand supplied from ME
- Is the Saudi oil industry in “twilight” mode (as Matt Simmons contends), or can it expand productive capacity significantly (as Saudi Oil Ministers contend)?



- Is market so distorted that reliable information required for efficient decision making by both oil producers & consumers is absent?
- Oil price increases are not bad *per se*, price volatility based upon uncertainty is the problem.
- If a rising oil price is perceived to be a long-term phenomenon, then investment in alternative technologies would be encouraged.
- Typically US\$20-\$25/b still perceived as appropriate price for investment decisions. US30-\$35/b would produce some interesting options!
- New technologies must minimise their environmental footprint!



Conventional/non-conventional oil

Definitions by no means universally agreed, but:

Conventional

- All oils having a specific gravity between 20° and 50° API

Non-Conventional

- Heavy oil & bitumen
- Oil shales & oil sands
- CTL and GTL technologies



New conventional sources

- **Deepwater**
2000-3500 metres (currently Gulf of Mexico, offshore W. Africa and offshore Brazil)
- **Arctic**
- **Super-deep reservoirs**
4000+ metres (e.g. North Sea's Elgin-Franklin is 6000 metres below the seabed)



Potential unconventional sources of supply

- **Heavy oil, bitumen and oil sands**

Large deposits in Canada, Russia, and Venezuela (recovery is highly capital intensive)

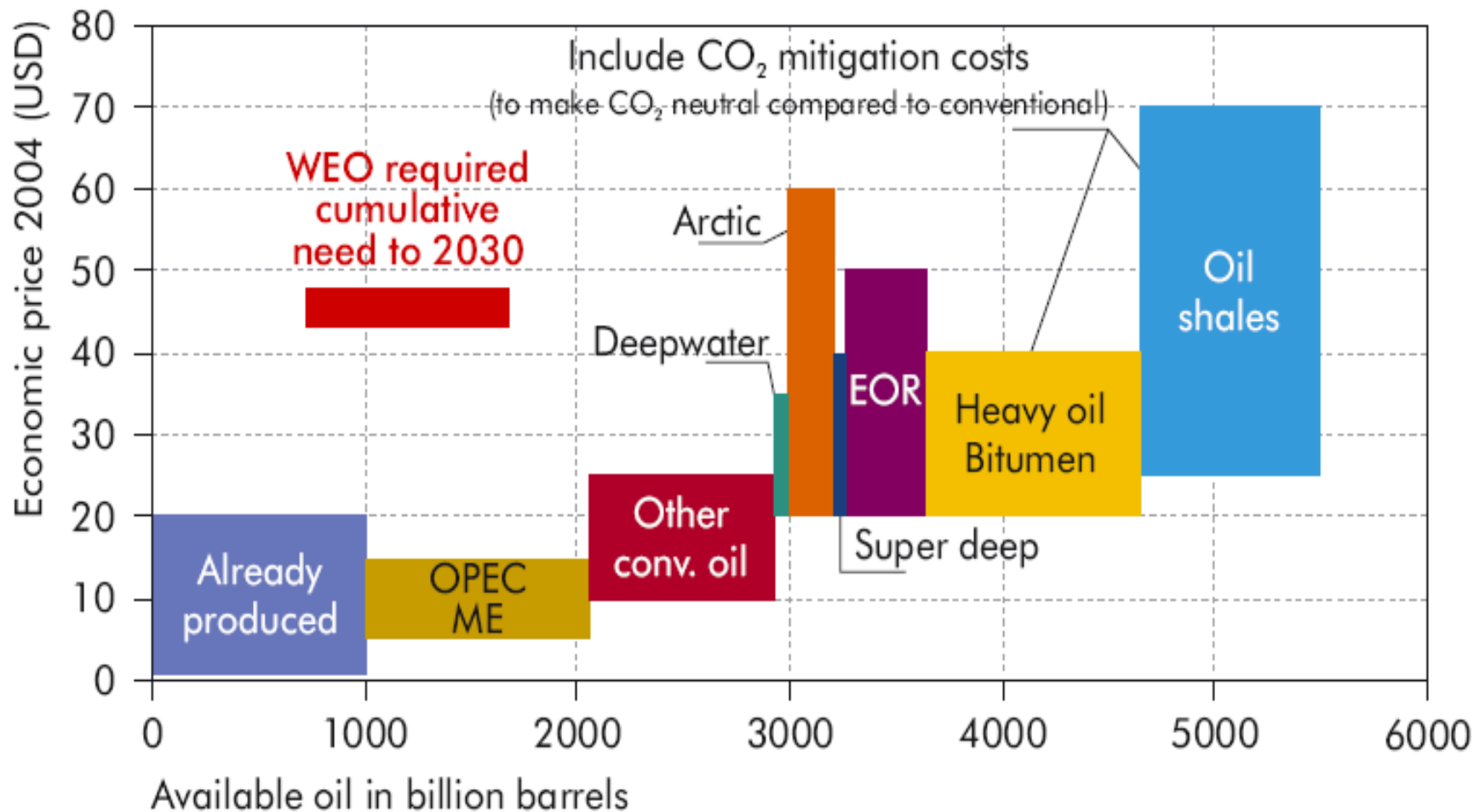
Potentially massive (4 trillion barrels in Canada and Venezuela alone: at 20% recovery these reserves outnumber all of those in the ME).

- **Oil shales**

Worldwide reserves 2.6 trillion boe.

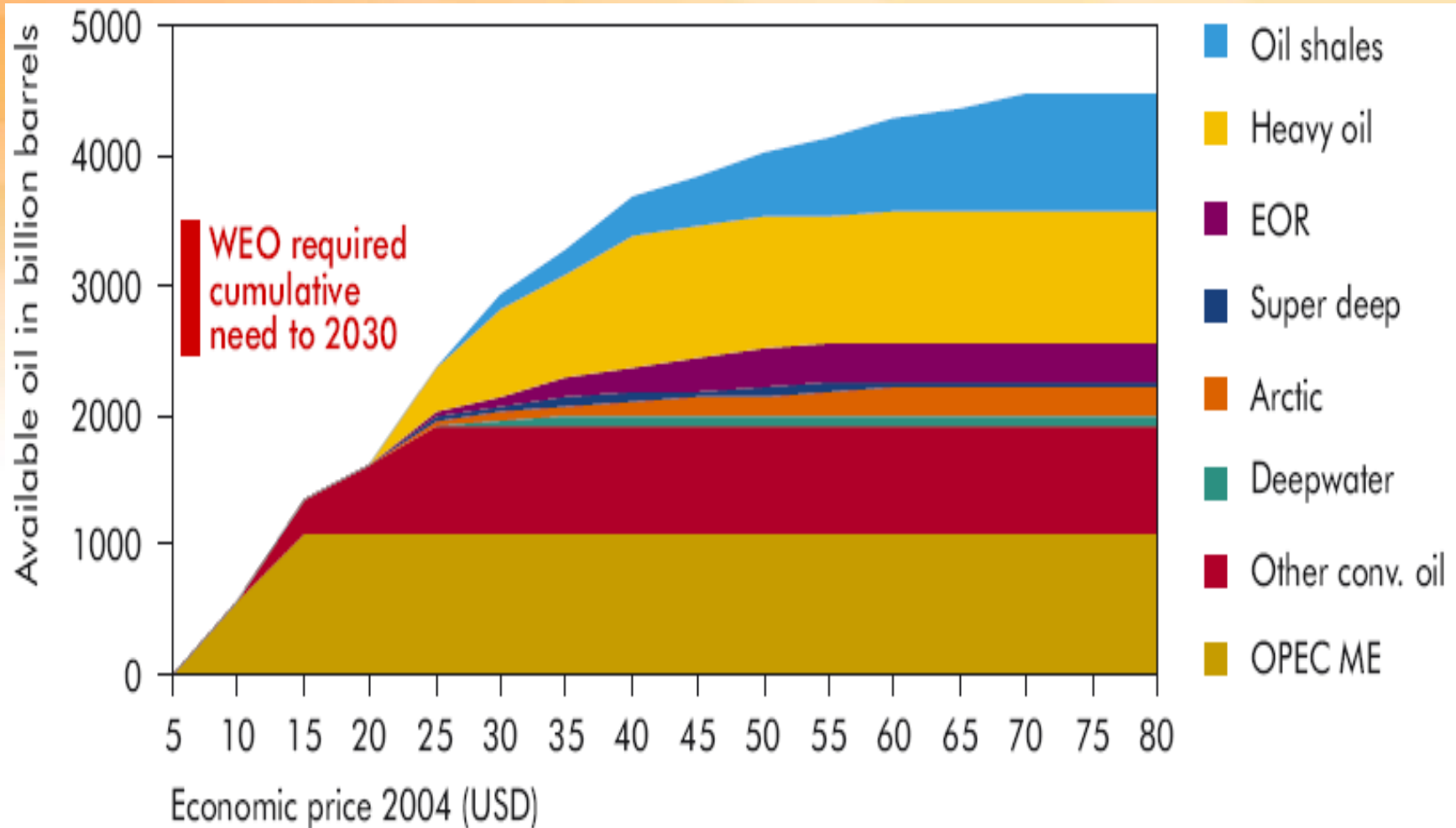


Oil cost curve, including technological progress: availability of oil resources as a function of economic price (Source: IEA)



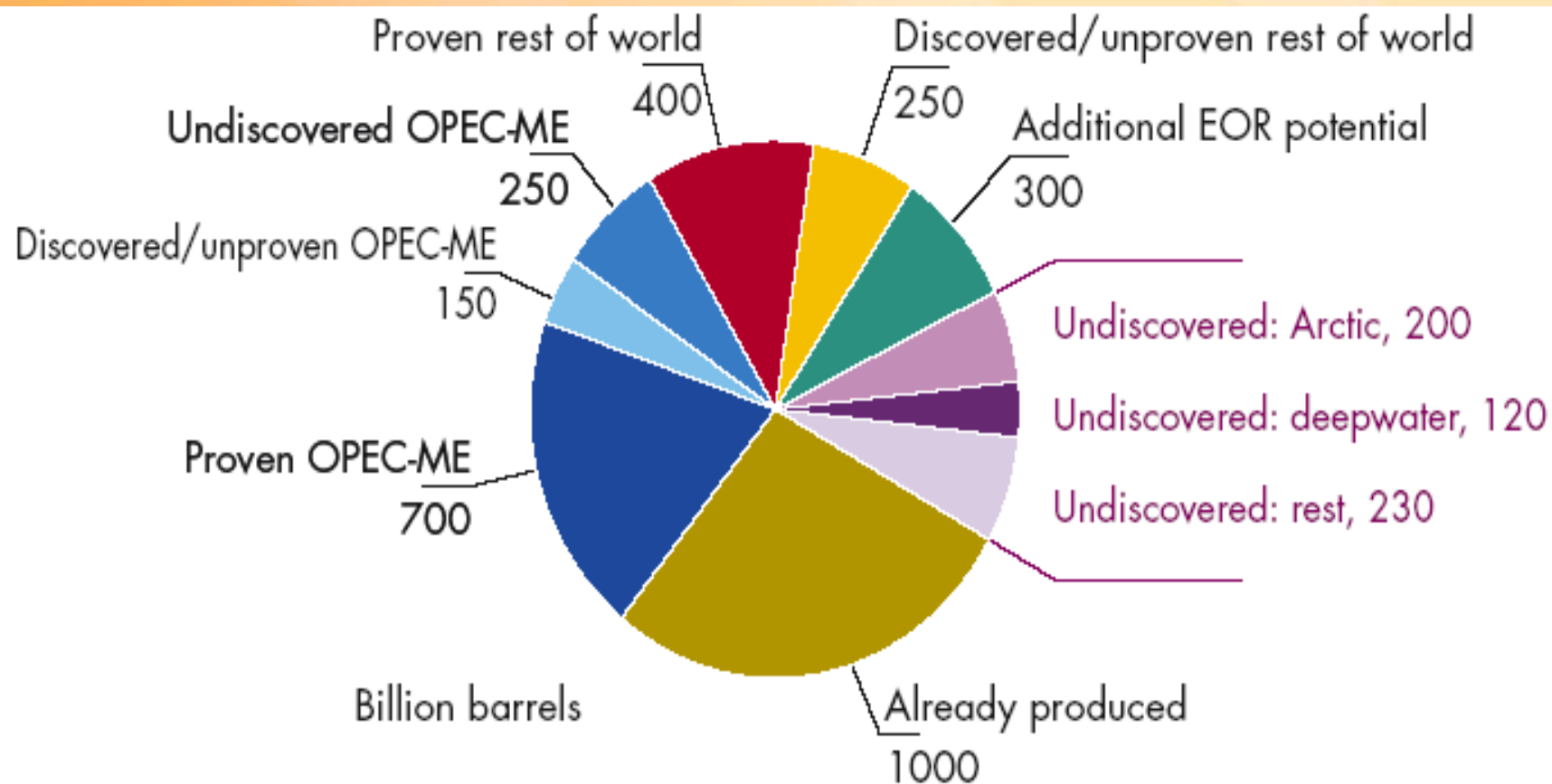


Oil cost curve: alternative presentation (Source: IEA)



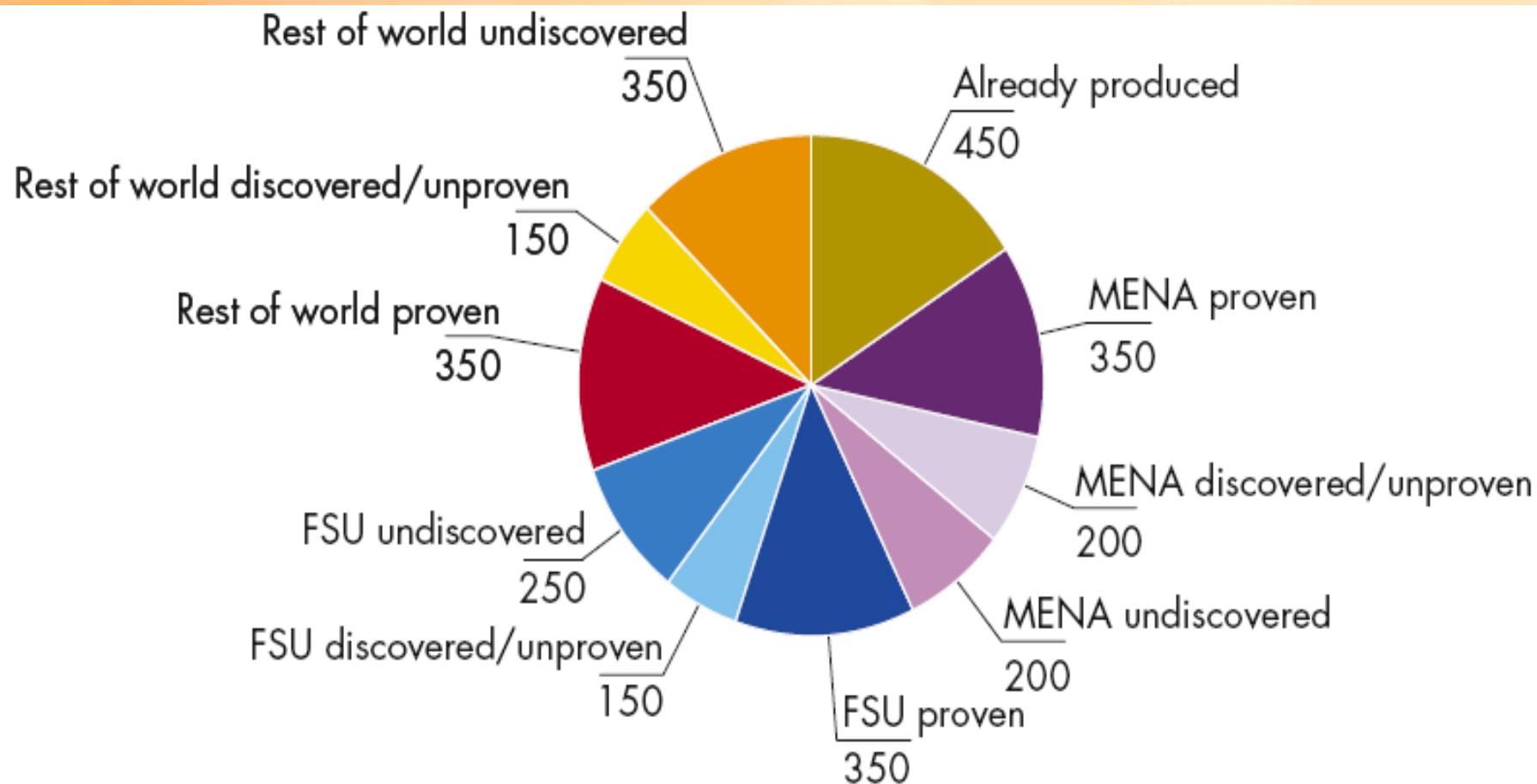


World ultimately recoverable conventional oil (Source: USGS & IEA)



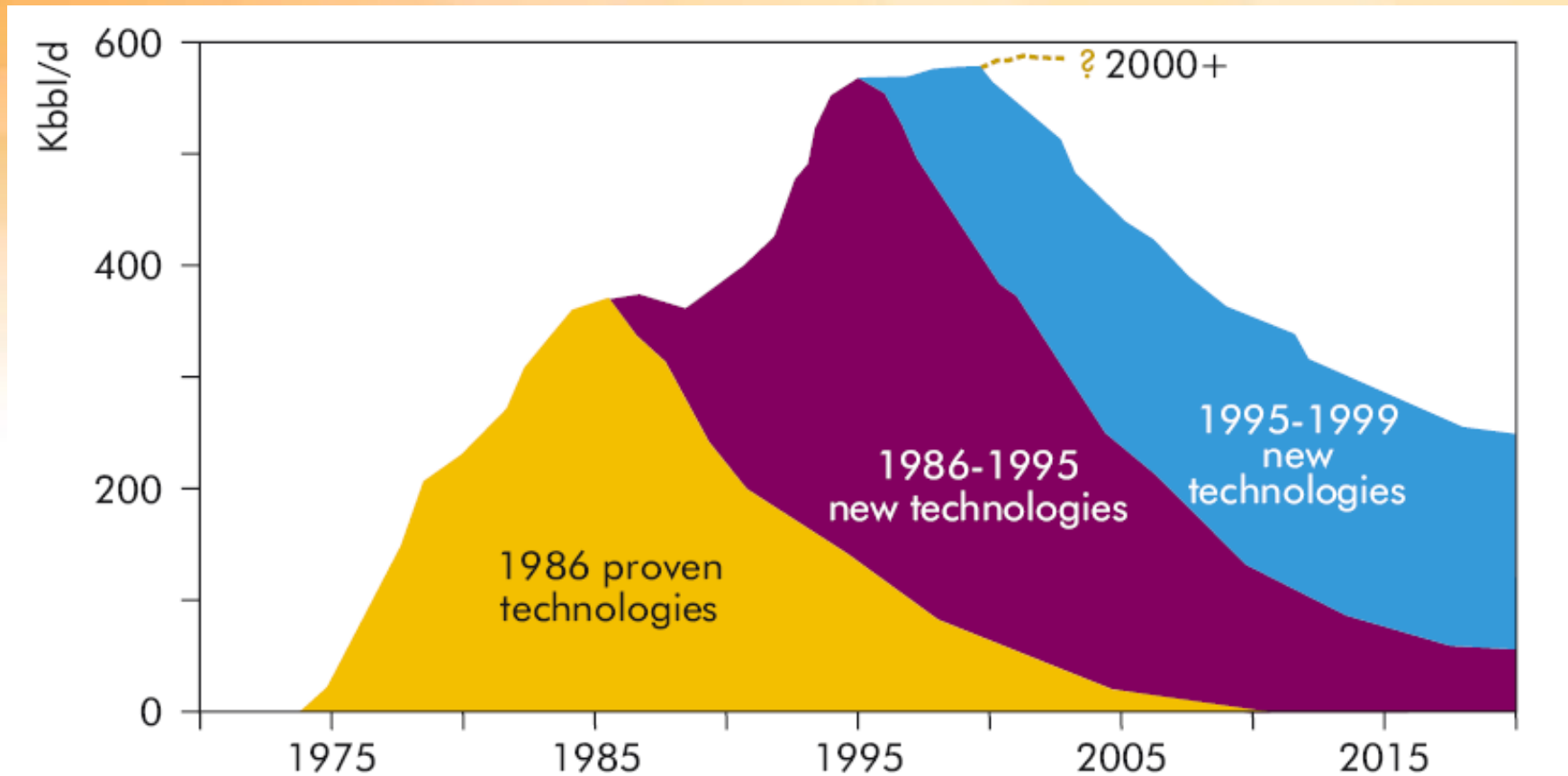


World ultimately recoverable conventional gas: billion barrels oil equivalent (Source: USGS, Cedigaz, & IEA)





Impact of technology on production from the North Sea in thousand barrels per day (Source: Shell)





Economics approach: do current crude oil prices reflect market fundamentals?

- OPEC: 40% of supply; 70% of proven reserves
- OPEC has acted in the past as the marginal supplier to “balance” the market
- Non-OPEC suppliers act as price takers
- When demand is close to productive capacity, OPEC’s ability to reduce prices is limited
- Current price-output configuration appears to be a short-run competitive equilibrium
- Crude oil price increases of 2004 largely explained by the unexpected rapid growth in consumption



- Crude oil price increases of 2005 largely reflect the uncertain environment and expectations of future market tightness in production capacity
- The perception of a limited response of investment to higher prices has reinforced these expectations
- Data problems with non-OECD countries in relation to supply, stocks & exports
- Refinery bottlenecks have raised product margins

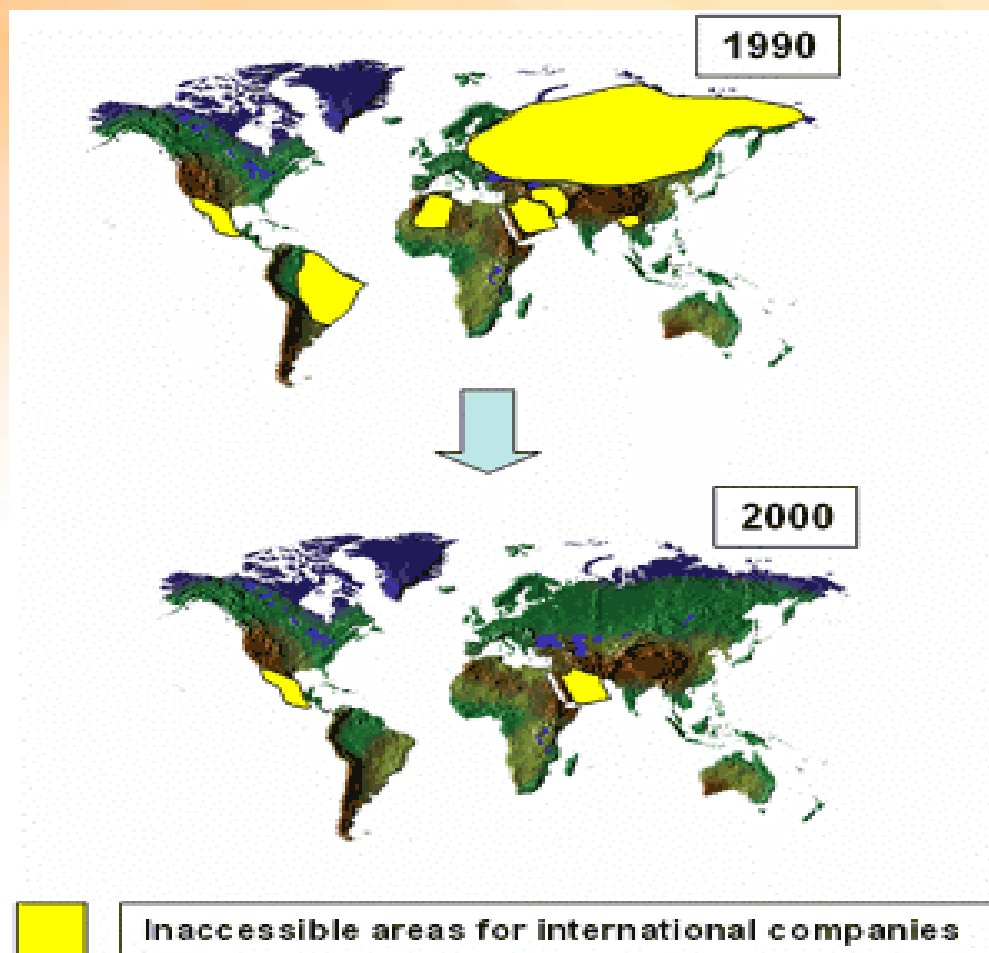


Why the lack of investment?

- Are 2004/2005 oil price levels a short-term phenomenon (lessons of past decades)?
- Middle East reserves dominate market sentiment
- Uncertainties about size of ME reserves and cost of developing them
- Saudi Arabia oil sector closed to foreign investment
- Many bottlenecks throughout the oil cycle contributing towards higher prices
- Shareholder expectations (short-term)
- Low refinery margins until recently



The changing oil environment (Source: Nystad)





World Energy Outlook 2005

IEA projections to 2030

- World energy demand to increase 50% (bau); 37% (env. policy)
- Cumulative investment of \$17 trillion required to ensure supply (\$3 trillion for oil, and equivalent to twice the annual amount spent over the past decade)
- Greater dependence on Middle East and North Africa (MENA) for oil and gas supplies
- Energy-related CO₂ emissions to rise by 52% (bau)
- Oil (2004) bau prices: \$35 (2010), \$39 (2030)
- Oil (2004) deferred investment: \$52 (2030)

The projected bau trends lead to a non-sustainable future, from both an energy-security and an environmental perspective



Implications for MENA oil exporters

- World oil demand to rise from 83 mb/d (2004) to 92 mb/d (2010) to 115 mb/d (2030)
- Oil production from MENA to rise from: 29 mb/d (2004) to 33 mb/d (2010) to 50 mb/d (2030)
- Oil production from Saudi Arabia to rise from: 10.4 mb/d (2004) to 11.9 mb/d (2010) to 18 mb/d (2030)
- Production increases also in Iraq, Kuwait, UAE & Libya
- Deferred investment scenario would lower requirements
- Is sufficient capital available for investment in oil exploration and oil production infrastructure?



Backstop technologies

Short-term technology

- Hybrid vehicles

Short-term fuels

- Methanol (environmental concerns – CO₂)
- GTL using stranded or associated gas (scale problems)
- Ethanol & biodiesel (scale problems)

Longer-term technology

- Battery vehicles
- Fuel cell vehicles



Price of alternative fuels (USA, September 2005)

Source: US Department of Energy

	<i>Nationwide Average Price for Fuel</i>	<i>Units of Measurement</i>
Gasoline	\$2.77	per gallon
Diesel	\$2.81	per gallon
CNG	\$2.12	per GGE
Ethanol (E85)	\$2.41	per gallon
Propane	\$2.56	per gallon
Biodiesel (B20)	\$2.91	per gallon
Biodiesel (B2-B5)	\$2.81	per gallon
Biodiesel (B99-B100)	\$3.40	per gallon



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Thank You