

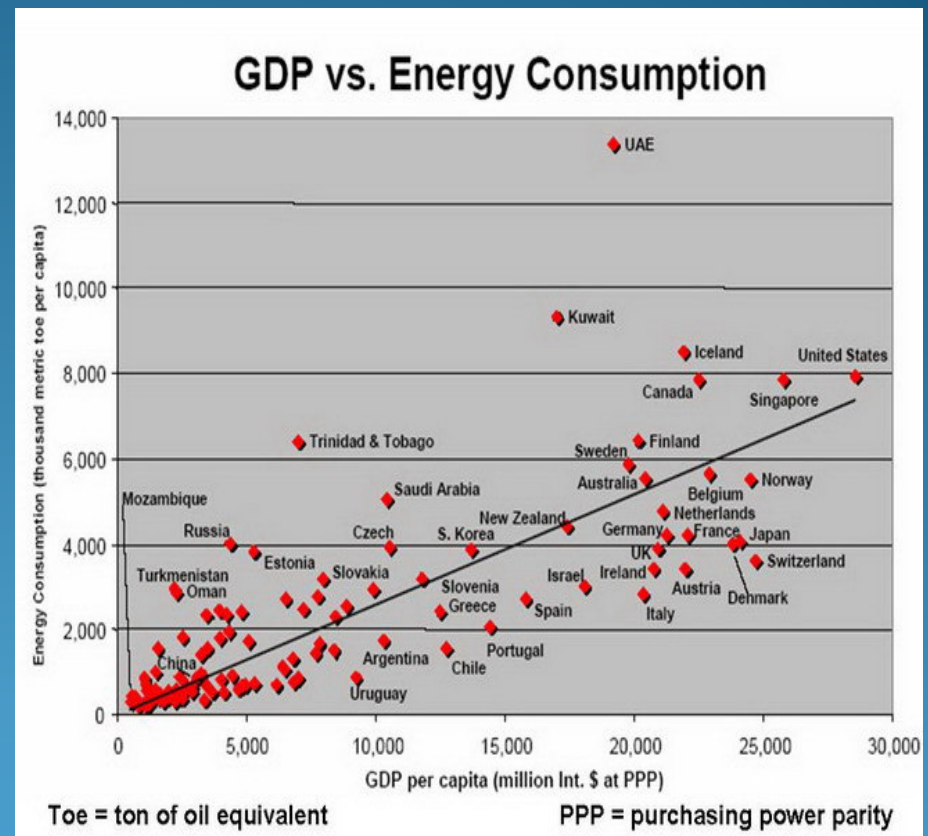


Peak Oil

The World's Energy Crisis

ENERGY=WEALTH

- Modern civilization is based on cheap, abundant energy
- *Oil* is the *primary energy source* for modern industrial society
- Energy consumption directly correlates to economic growth
- *Oil is a finite resource*
- Less oil = economic contraction
- Oil production has stagnated the last 3 years, even with demand growth of 1.6% yr



PEAK OIL DEFINED

- **Geological:** From a purely technical standpoint, 'Peak Oil' occurs when the amount of oil that can be extracted from the earth peaks and begins a terminal decline due to geologic factors
- **Financial:** Financially speaking, when it costs more to extract a barrel of oil than that barrel is worth, a financial peak has been reached
- **Practical:** In terms of oil flows, peak oil occurs when supply is unable to keep up with demand indefinitely, whether due to geologic or 'surface' factors

OIL FLOWS vs. RESERVES

- Peak Oil is concerned with 'Oil Flows', not 'Reserves'
- 'Oil Flows' refers to the global *volumetric flow rate* = v and is conventionally measured in Barrels per Day
- 'Reserves' refers to the amount of oil left in the ground
- Even if 'reserves' remain high, if 'oil flows' cannot be increased and then subsequently decline, the world has reached 'Peak Oil'

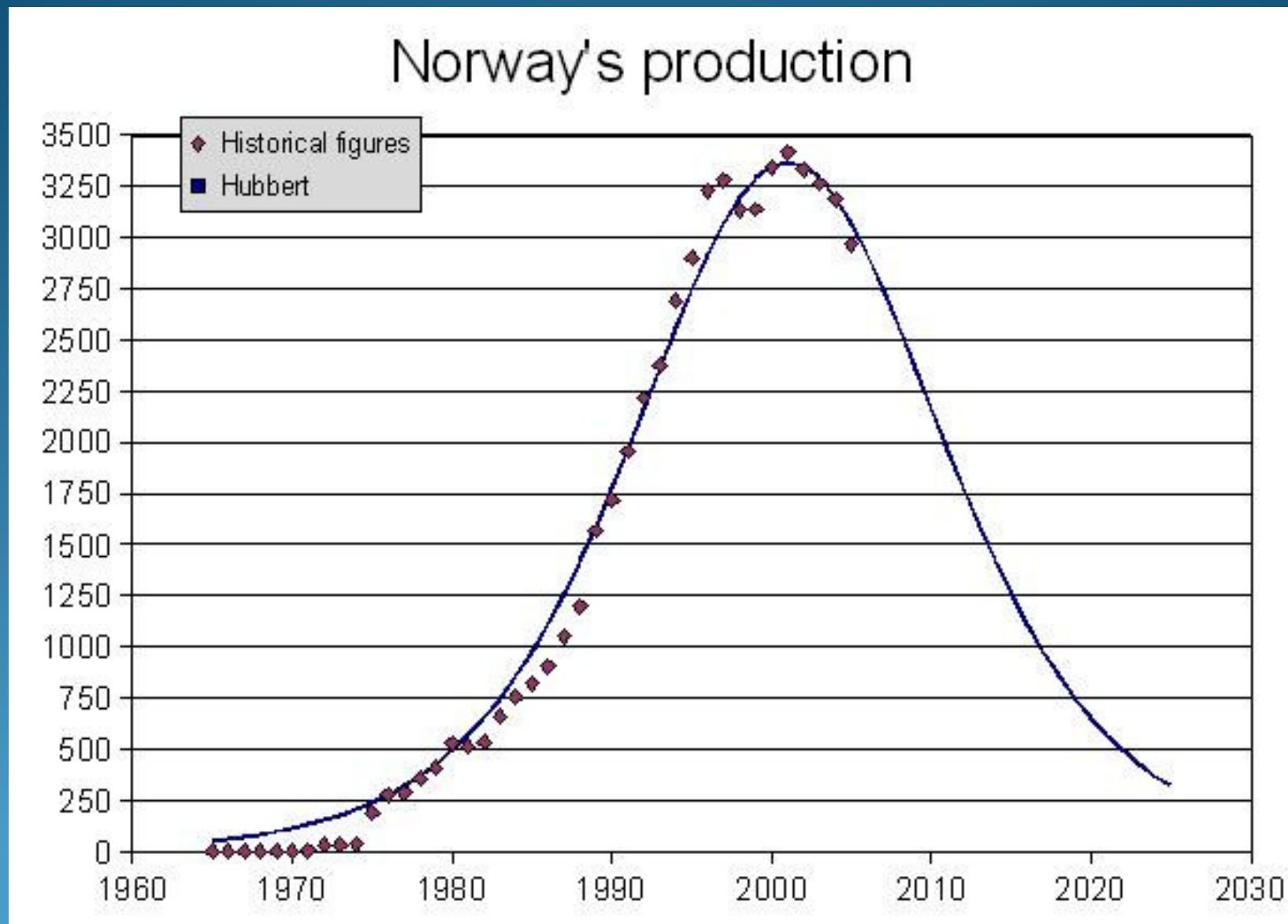
HUBBERT'S CURVE

- In 1956 M. King Hubbert, a geologist working for Shell Oil, was the first to predict that oil production in the continental U.S. would peak between 1966-1971 – actual peak in 1970
- He used a mathematical model of oil production over time defined by this equation: $dQ/dt = r_0 Q (1 - Q/K)$; where Q is the cumulative oil production, dQ/dt is the annual production rate, r_0 the initial production growth rate, and K the reserves.
- This equation defines a logistic function which yields a 'Hubbert' curve

HUBBERT'S GLOBAL PEAK

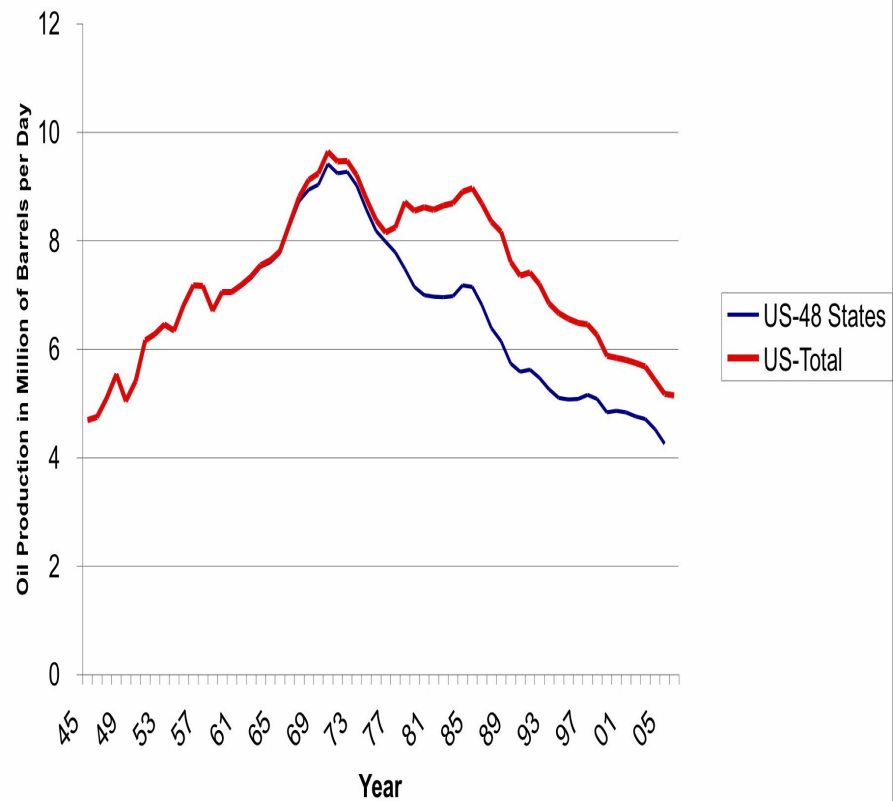
- Hubbert predicted peak global oil production around the year 2000
- In a 1976 TV interview he updated his forecast, saying that OPEC action during the 1970's oil crisis would delay peak production by up to 10 years
- His prediction falls between 2000 - 2010

H CURVE APPLIED TO NORWAY



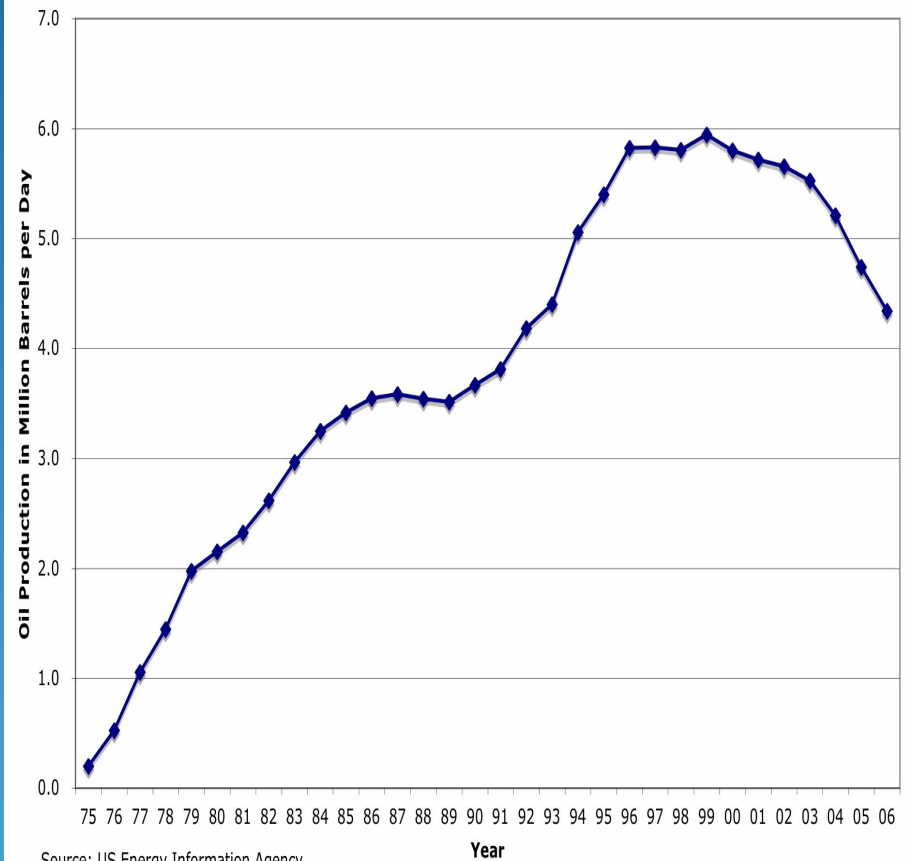
HISTORIC PRODUCTION CURVES

Figure 1: US Oil Production Has Been Declining Since 1970



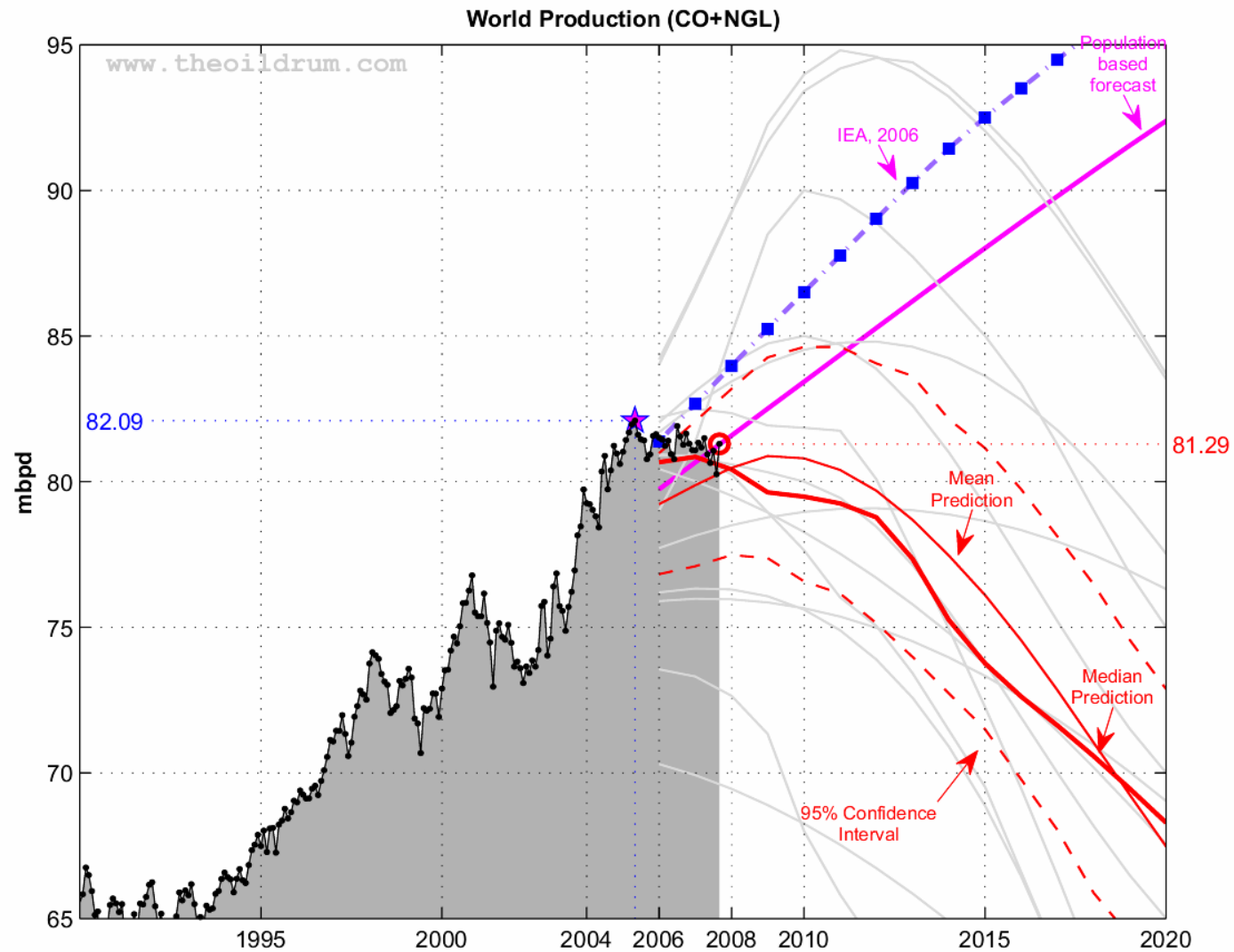
Source: US Energy Information Administration

Figure 2: North Seas Oil Production Has Declined Since 1999

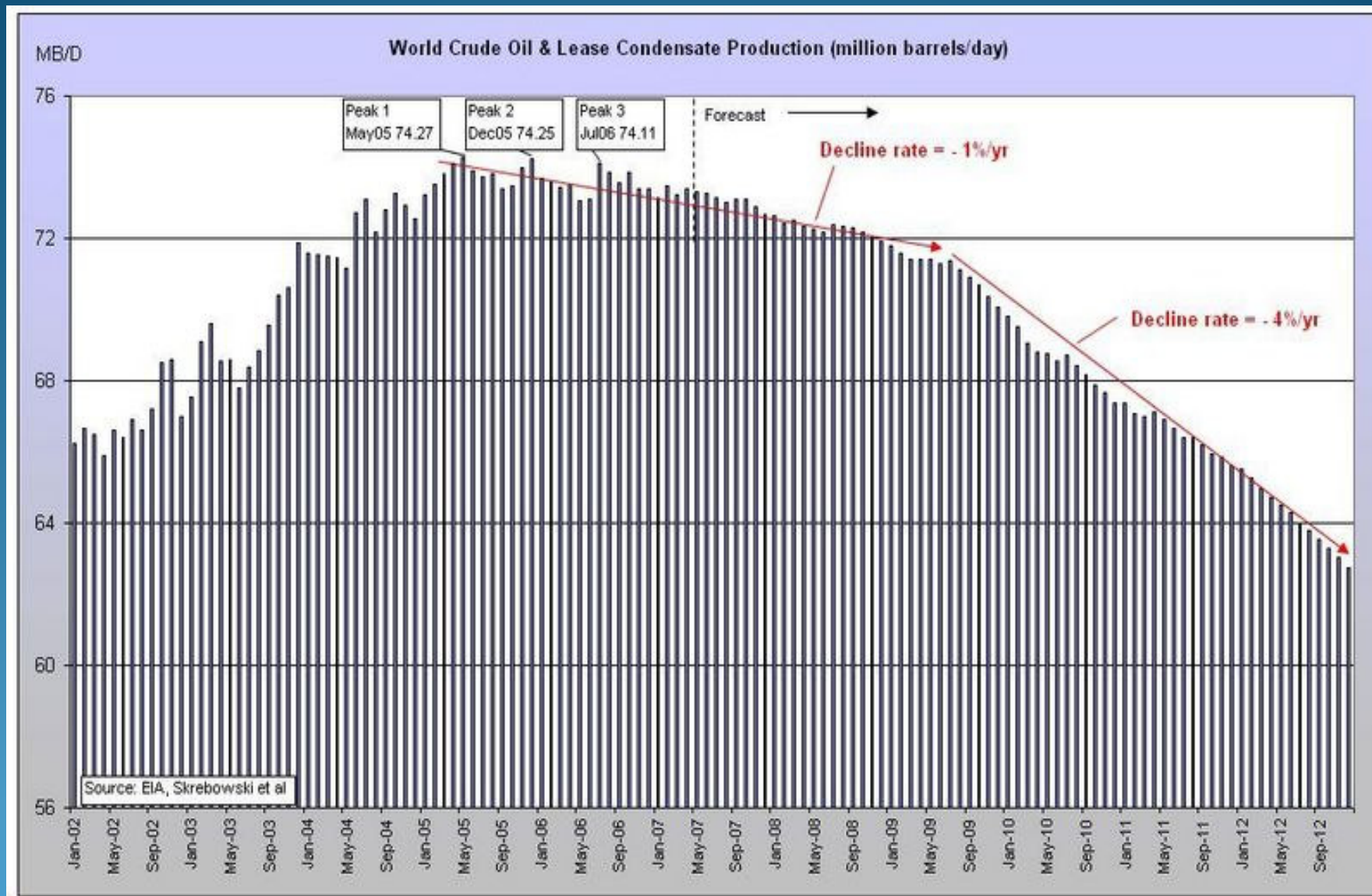


Source: US Energy Information Agency

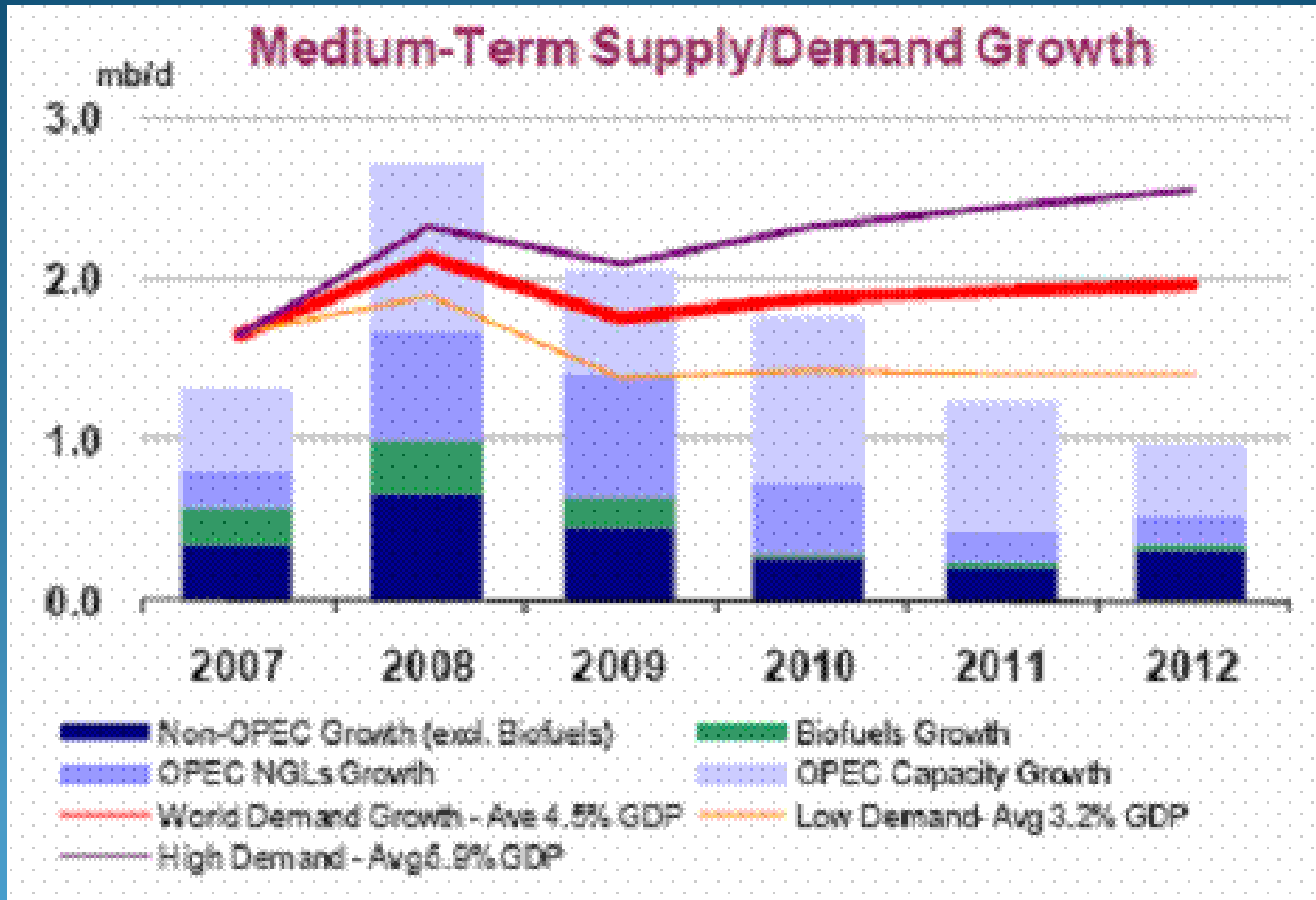
ANNUAL OIL FLOWS (EIA)



EIA CO DECLINE RATE



EIA FUTURE FORECAST



EXPERTS ACKNOWLEDGING PEAK OIL IS IMMENENT

- **Chris Skrebowski** – Former oil market analyst; Current editor of the UK Petroleum Review; ODAC analyst
- **Matthew Simmons** – Oil investment banker/analyst; former advisor to president Bush; says peak is here now
- **Jeroen van der Veer** – Shell Oil's CEO; emailed all employees saying that oil companies will not be able to meet oil demand beyond the year 2015
- **Jim Buckee** – Retired Talisman CEO; PO here now
- **Germany's Energy Watch Group** – PO here now



The Looming Energy Crisis

2007 Canaries in the Coal Mine

South Africa - Power Outages

- Power shortage arrived suddenly and unexpected
- Projected to cut economic growth by some 2-3%, and last at least 5 years
- Eskom, SA's main utility company, plans to double consumer prices to pay for new projects
- Affecting global commodities market
- Lessons – Plan for the worst; Invest in current infrastructure

CHINA – FUEL & COAL SHORTFALLS

- China has been rationing petrol and diesel since 10/07 due to severe shortages
- For the first time in its history, China consumed more coal than it produced
- Coal net exports in 2007 = 2 million tonnes vs. net exports in 2006 of 25.1 million tonnes, a 92% decrease
- Coal shortages have led to power outages
- China's government has instated price controls to deal with rampant inflation
- Lessons – Energy exporters can quickly become importers, placing further pressure on world demand; Inflation endangers gov't

OTHER SHORTAGES

- Tajikistan
- Nepal
- Zimbabwe
- Kenya
- Argentina
- Australia
- And 86 other regions around the world have experienced some type of fuel/power shortages within the last year

COMMODITIES & INFLATION



COMMODITY PRICES

1 Year Price Increase

- Oil: + 65%
- Corn: +50%
- Soybeans: +86%
- Wheat: +127%
- Cocoa: +45%

LEADERSHIP

Kings and Pawns



THE ROAD AHEAD

- We need government and business leaders to begin planning and investing for a lower energy future
- The RRC
 - Renewable Energy
 - Reinvestment in conventional energy infrastructure
 - Conservation
- Civil unrest may result in areas where fuel shortages & inflation combine with poor leadership

KEY POINTS TO TAKE AWAY

- Peak Oil is a matter of when, not if
- Peak Oil affects all aspects of modern life – the economy, government, and social stability
- With proper planning, we can mitigate the fallout from peak oil and engineer a more sustainable future
- Finally, we must invest all available resources into renewables, clean tech, and efficiency & conservation

THANK YOU FOR YOUR TIME AND ATTENTION

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