
Peak Oil – The Beginning of an End

Prepared
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Peak Oil Discoverer M. King Hubbert 1903-1989

- Shell Oil Geologist/ Petroleum Scientist
- In 1954 predicted 1970 U.S. Peak Oil year
- Universally criticized at the time



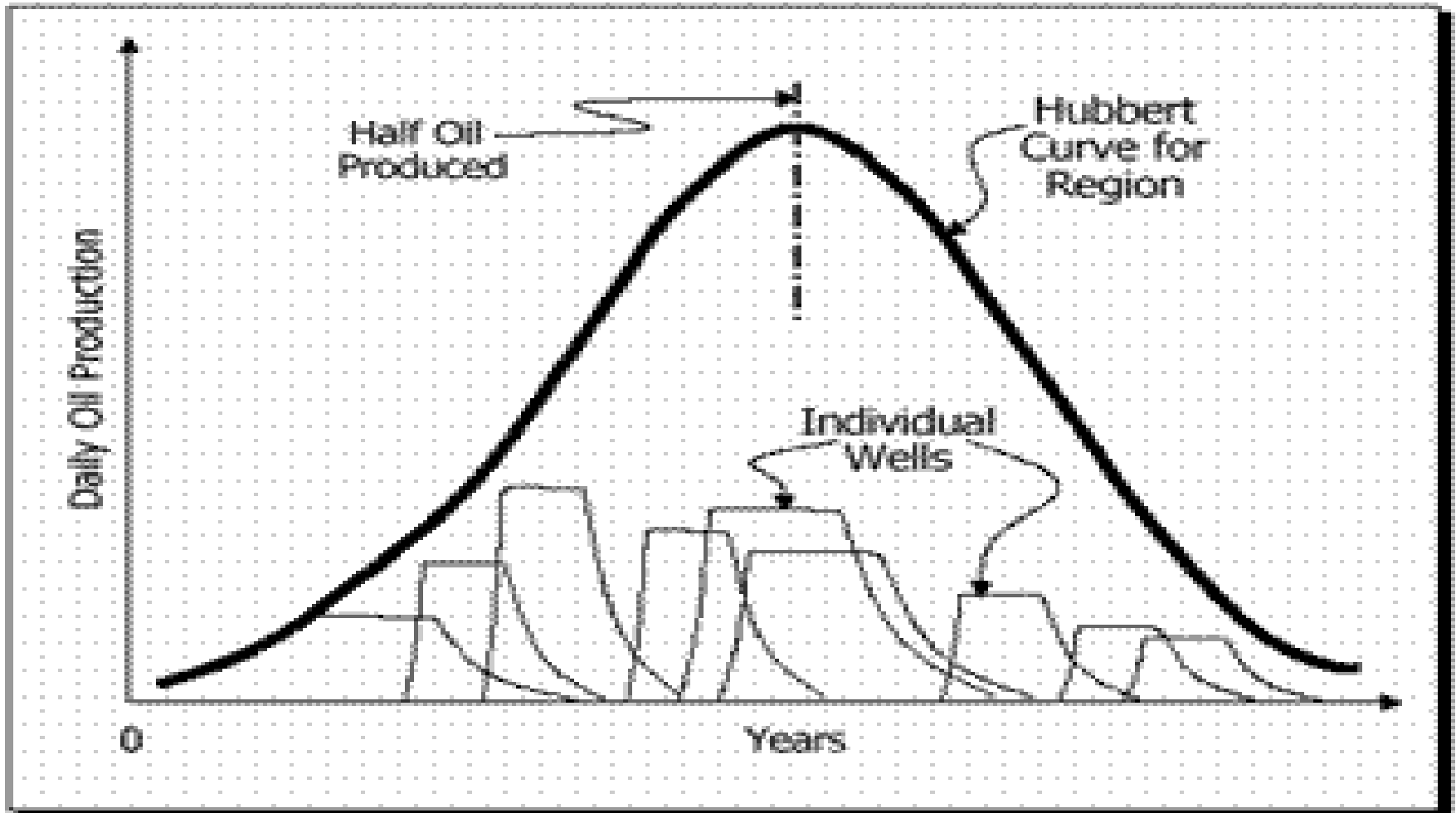
What is Peak Oil?

- **The year that an area's oil production reaches its maximum.**
- **Means that half the oil is gone.**
- **From this point on: “running out of oil.”**
- **Production declines continuously.**
- **<http://www.energybulletin.net/primer.php>**

The Hubbert Curve

HUBBERT CURVE

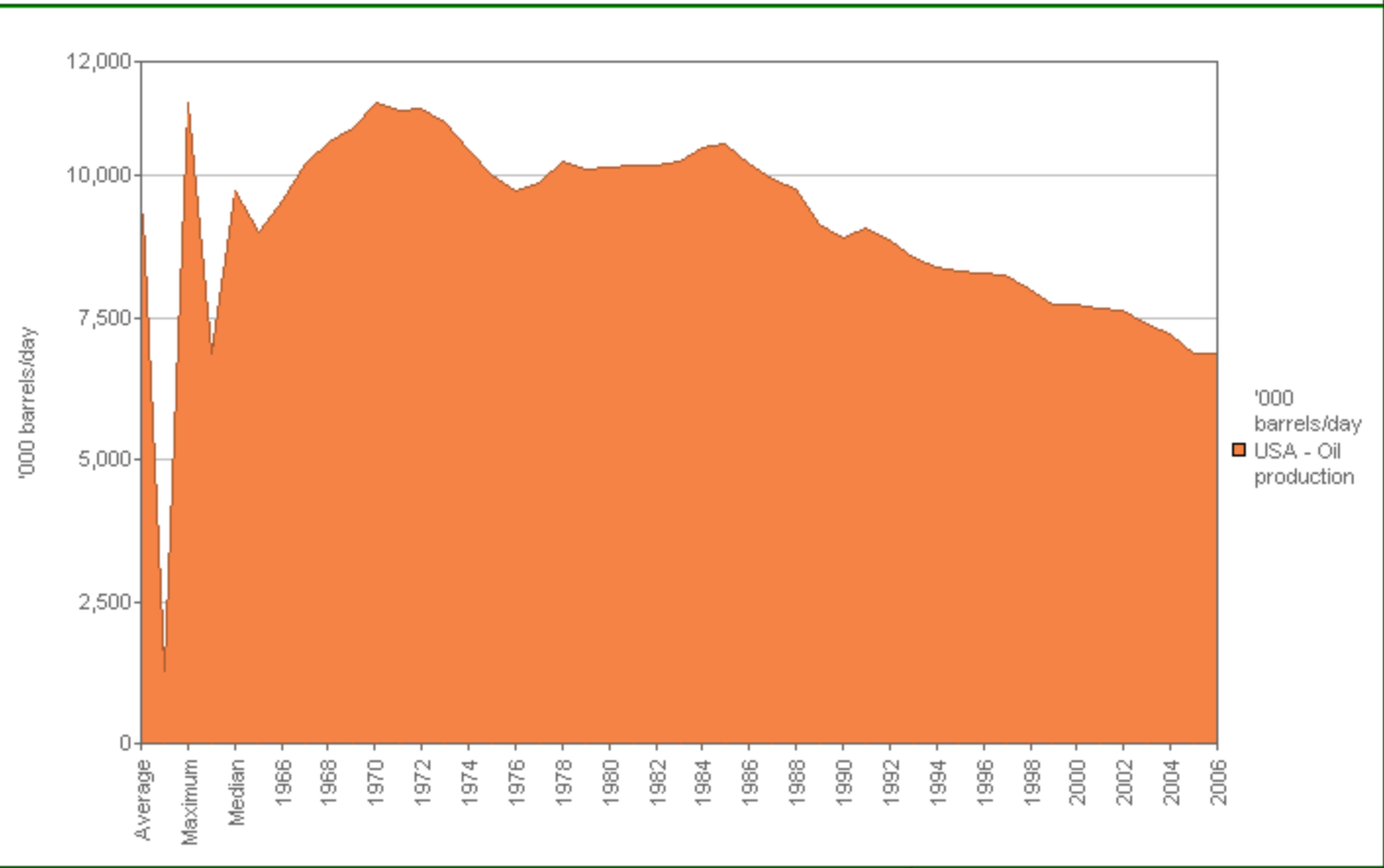
Regional Vs. Individual Wells



Help

Notes

View Chart Type Calculate Reports Export Help



Select one or several with the Ctrl key

- Total World Oil production
- Total North America - Oil production
 - USA - Oil production

- All
- 1965
- 1966
- 1967

Basic Resource Terminology

- **Depletion – Exhaustion of oil or any natural resource.**
- **Discovery – the past record of finding sources of a fuel.**
- **Production – the extraction and refining of oil into fuel.**
- **Demand – an estimate of the future usage requirements.**
- **Lag – the time from discovery to production/consumption.**
 - 5 to 20 years for oil

Six Key Ideas

- **Assumption 1: Peak Oil is real and imminent**; worldwide oil production is unlikely to ever exceed 85 million barrels per day by a significant amount.
- **Assumption 2: Once at Peak, oil production will be at a plateau for some period**, during which the possibility for further production increases will be in dispute and may be obfuscated by temporary recession-led declines in demand.
- **Assumption 3: No [one will announce] Peak Oil in any way that will generate an immediate global response, and the public perception and reaction to Peak Oil will occur in fits and starts** and be very uneven among countries (with the U.S. lagging).
- **Assumption 4: There is no viable alternative to oil**, at least in the short term.
- **Assumption 5: There is some time window ahead of us before a broad recognition of Peak Oil.**
- **Assumption 6: Most [people will be] "living in two worlds"**, tracking the breadth of Peak Oil developments and unevenly planning for the worst case and working at a "normal" job which may have no future in a post-Peak scenario, living in an urban or suburban environment, sending children to public school.

Is “Peak Oil” Real?

- “The peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, **the economic, social, and political costs will be unprecedented.** Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, **they must be initiated more than a decade in advance of peaking.**”
- http://www.pppl.gov/pollImage.cfm?doc_Id=44&size_code=Doc

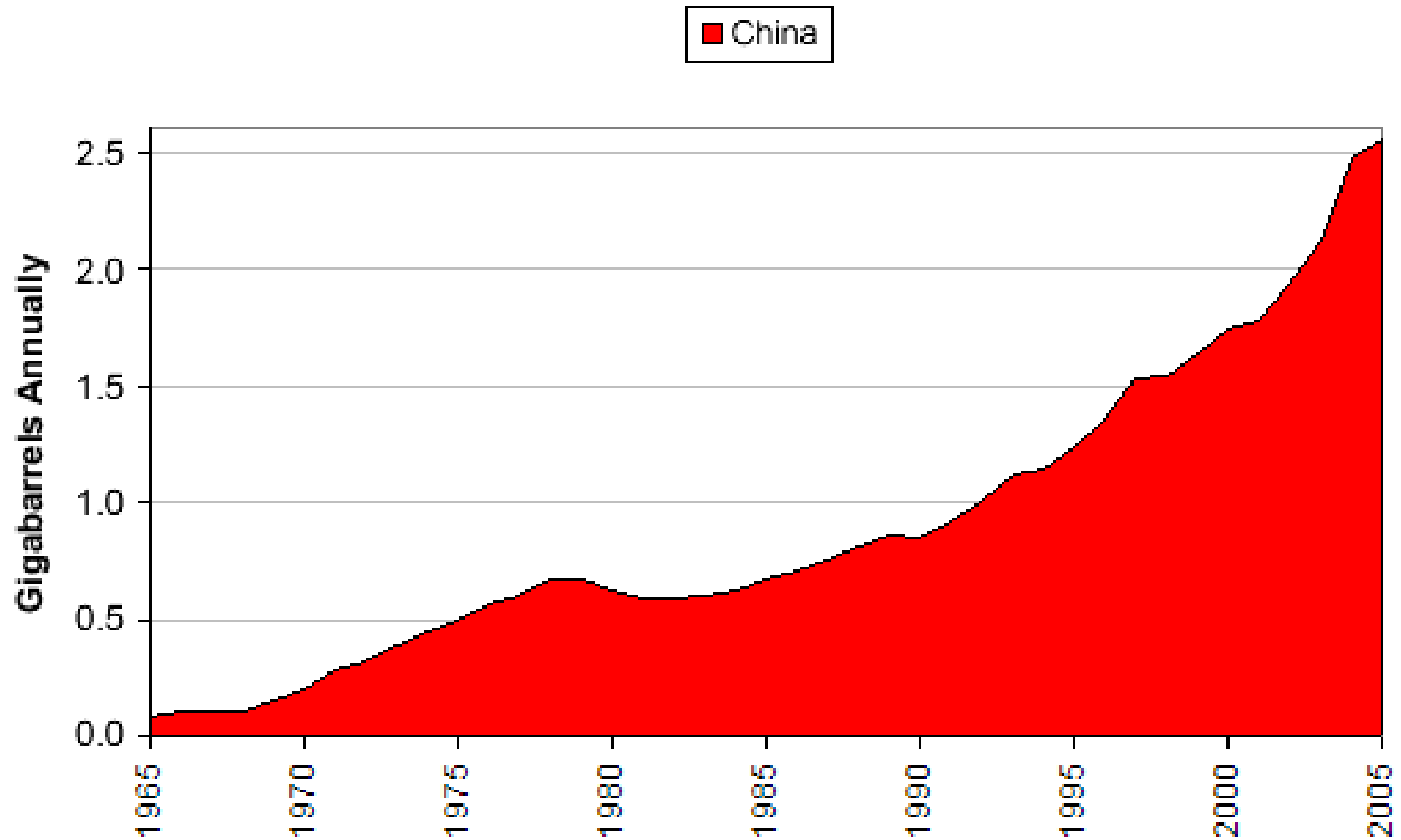
Is “Peak Oil” Real?

- “In the BP Statistical Review for 2005 (using data from 2004), the length of time [before the world runs out of oil] is 40.5 years”.

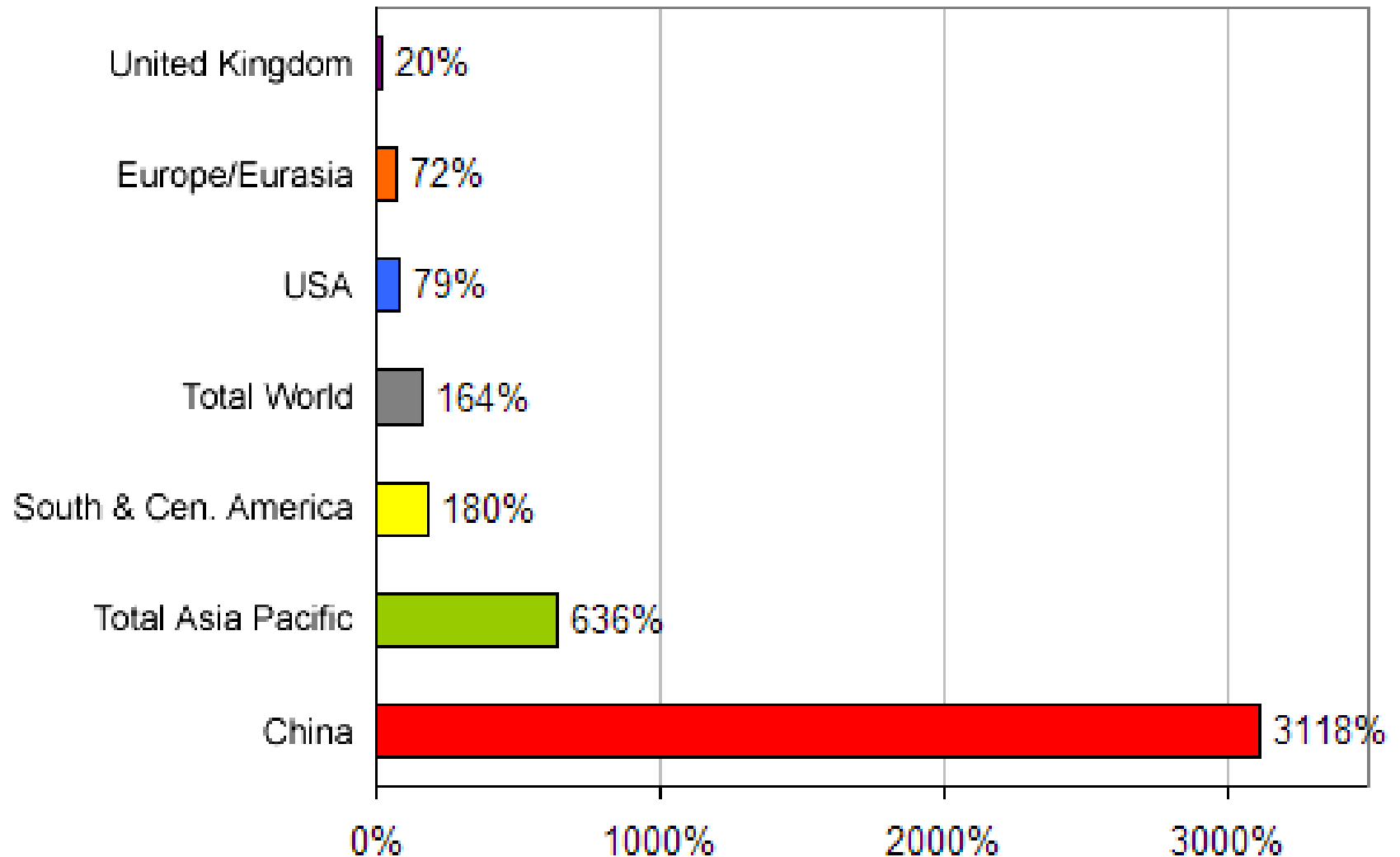
Increased Oil Demand

- World currently use 85 million barrels per day.
- Will use 113 million BPD by 2020.

China



China's Increased Oil Consumption



World Oil Discovery/Production Dates

- 1930s – the US Oil Discovery Peak year
- 1965 – the World Oil Discovery Peak year
- 1970 – US lower 48 Production Peak year
- 1981 – Discovery/Production Gap
 - Date when production began to exceed discovery
- When is the world oil peak (maximum production)?
 - Ken Deffeyes – author “Hubert’s Peak”: 2004-2008
 - Colin Campbell – ASPO founder: 2010

Interactive Map

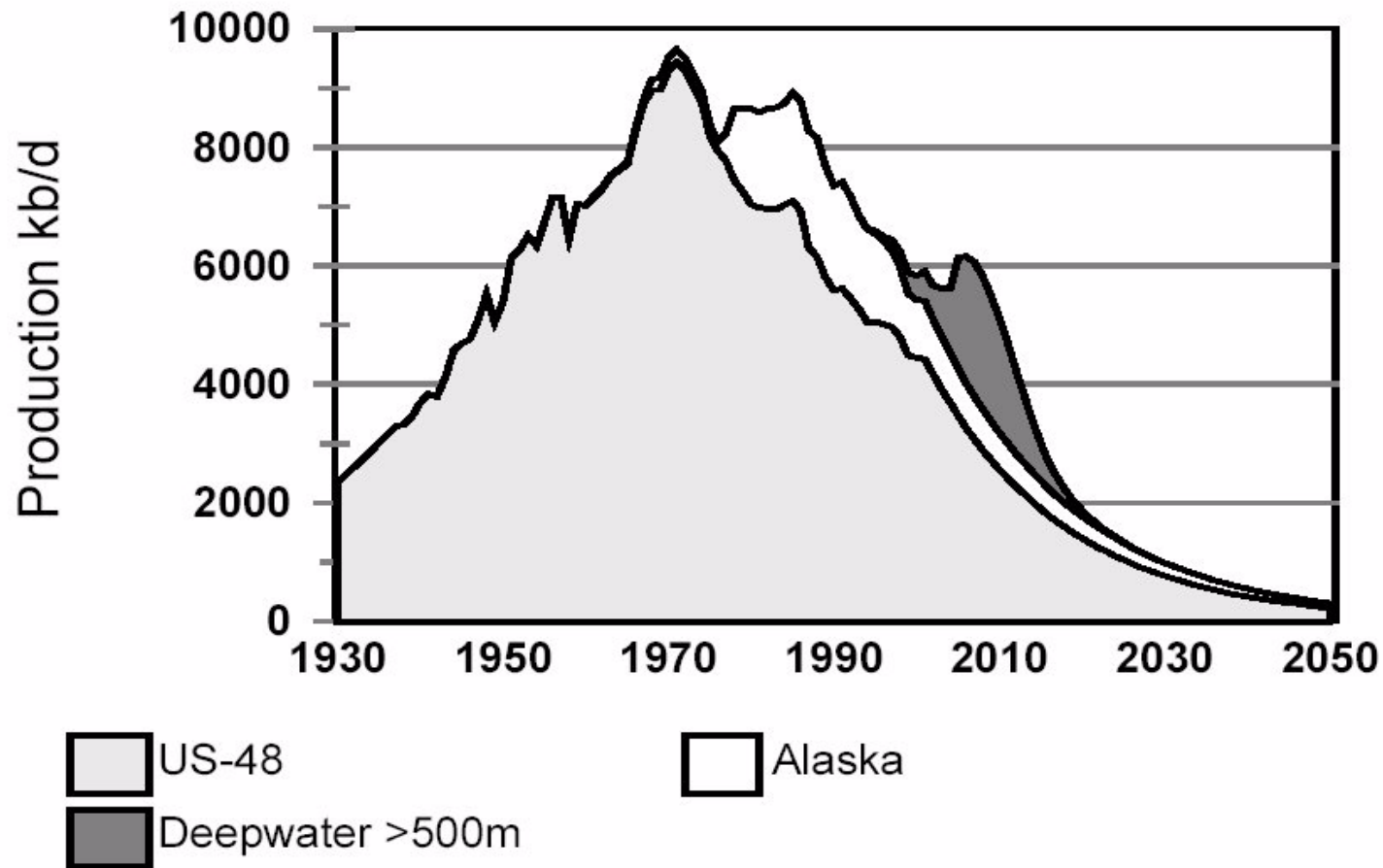
- <http://www.lastoilshock.com/map.html>

Peak Oil Discoverer M. King Hubbert 1903-1989

- Shell Oil Geologist/ Petroleum Scientist
 - Highly qualified and courageous
- In 1954 predicted 1970 U.S. Peak Oil year
- Universally criticized at the time
 - After 1970 became highly respected
- **In 1984 predicted world peak early 2000s.**

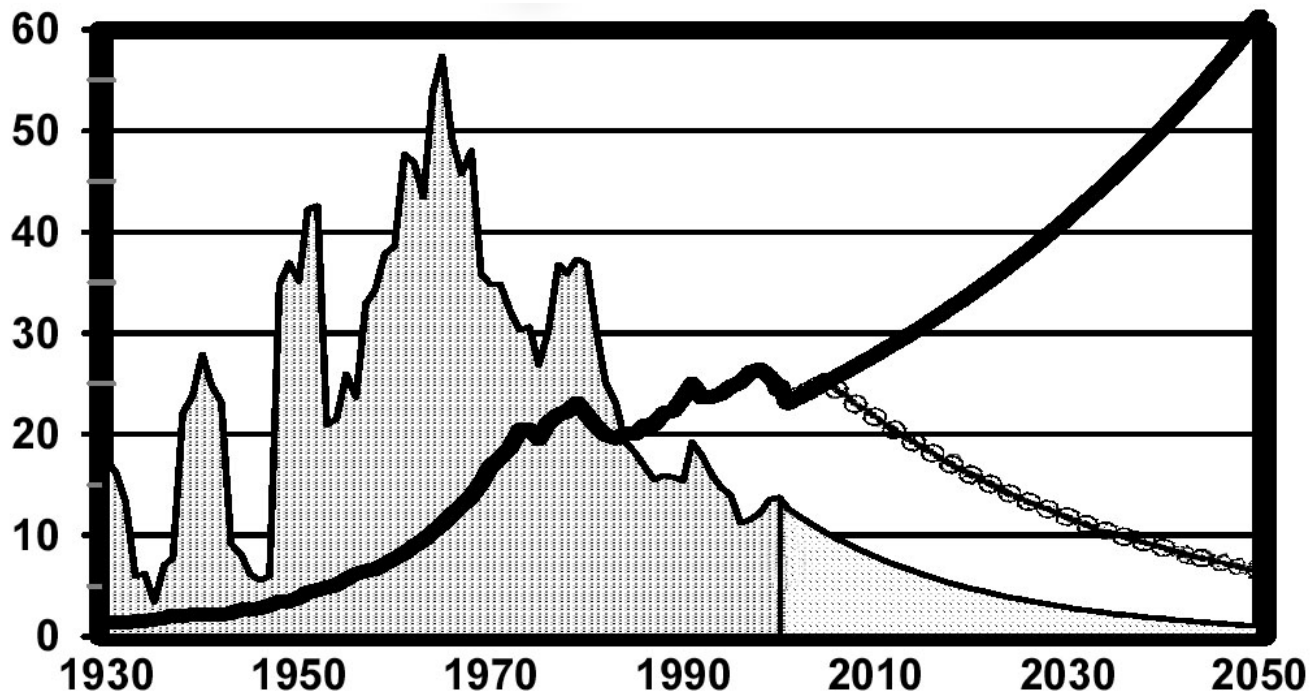


U.S. Production Peak - 1970



- Measured in 1000 barrels per day

World Supply Shortfall – Billions of Barrels



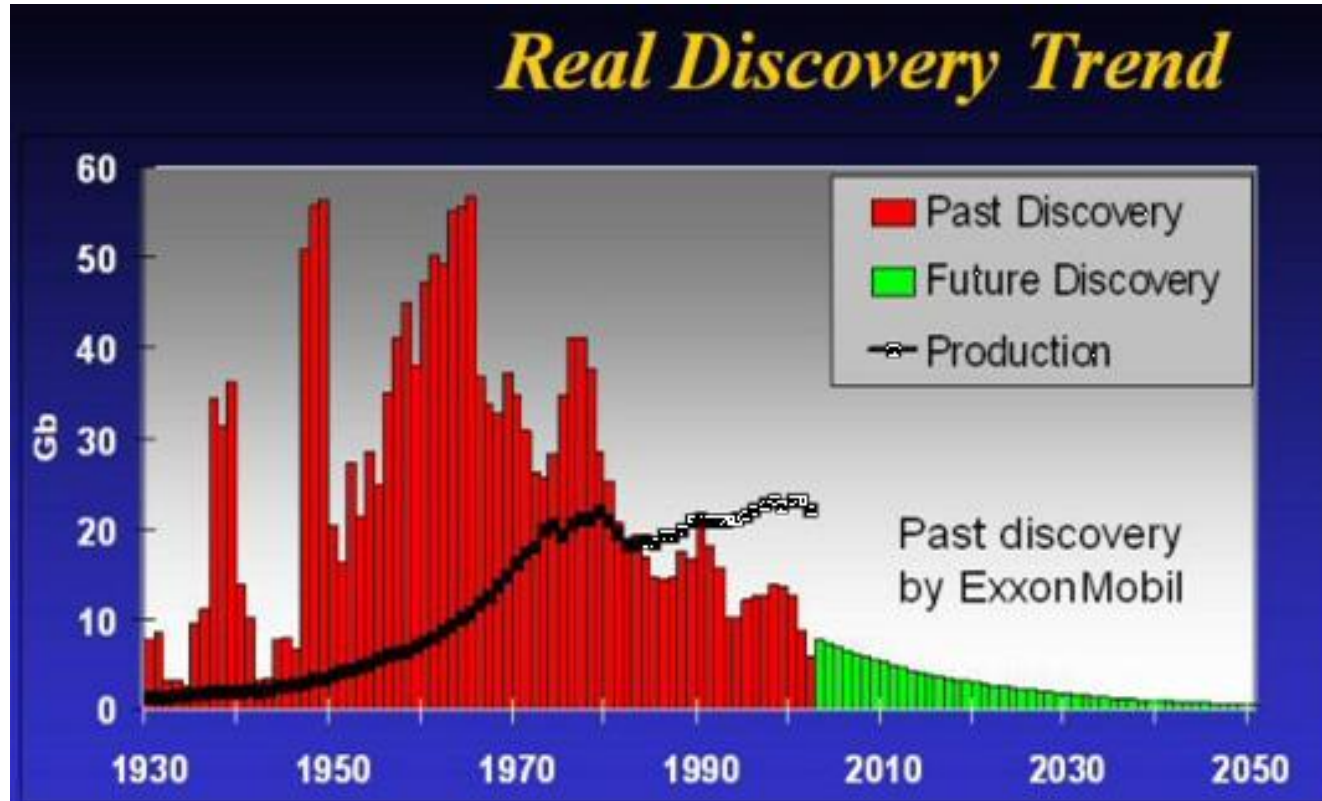
Discovery

Production Forecast

Demand + 2% growth

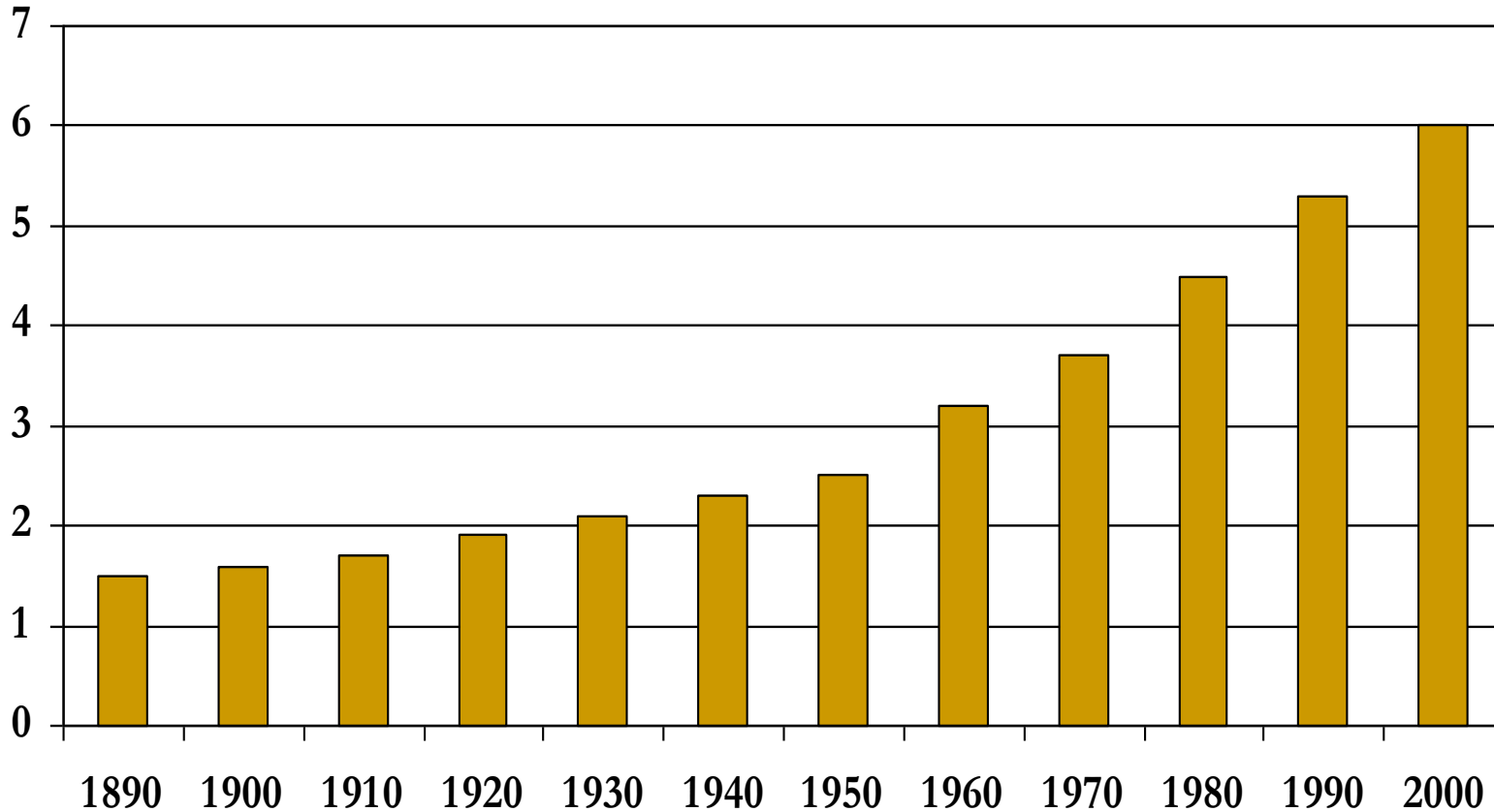
- From the Association for the Study of Peak Oil (ASPO) 2002
- All liquid hydrocarbons

World Discovery & Production ASPO 2003



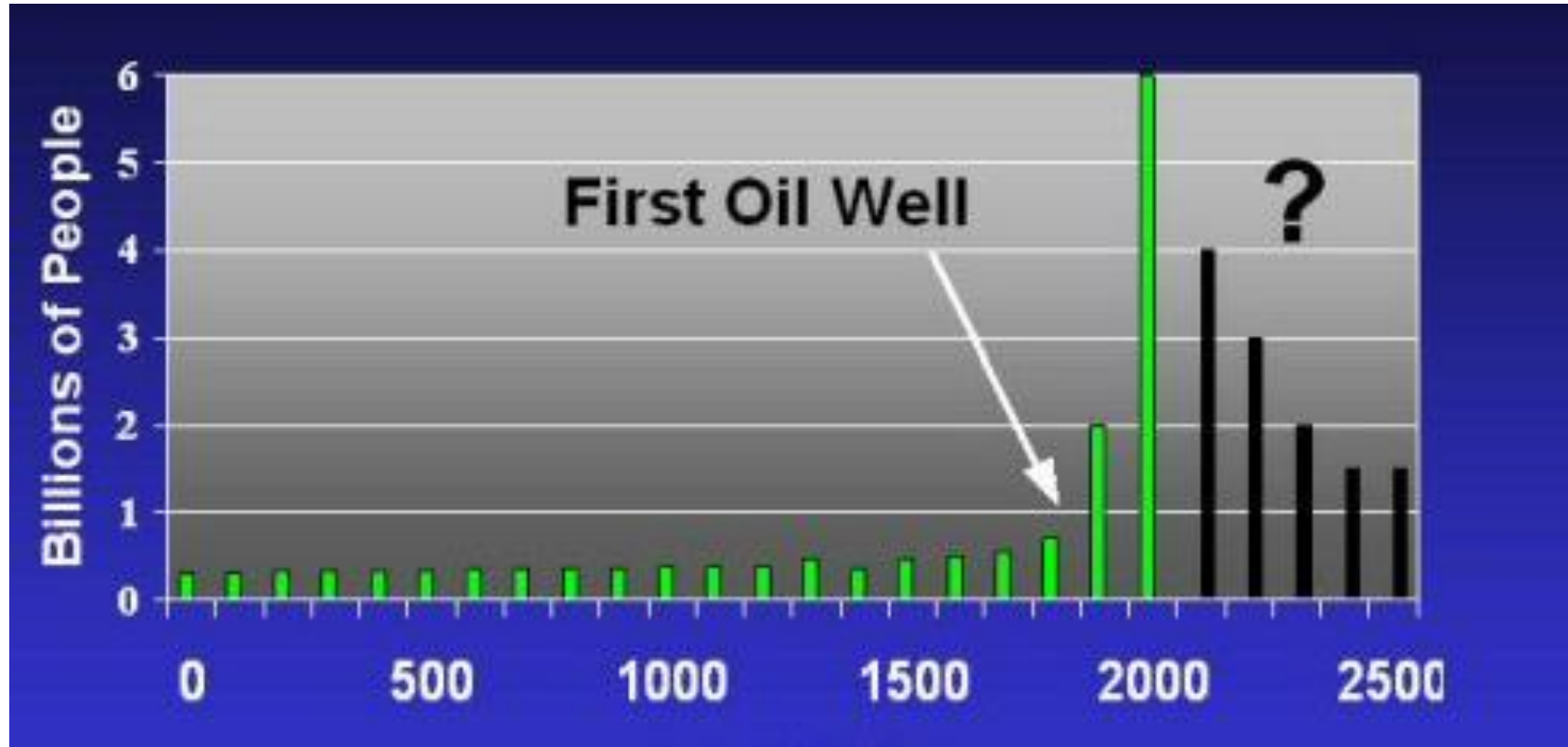
- Using ExxonMobil (world's largest oil company) Data
- Current ratio – 1 discovery barrel for 6 production barrels
- Uses 4D visualization and horizontal drilling

World Population - Billions



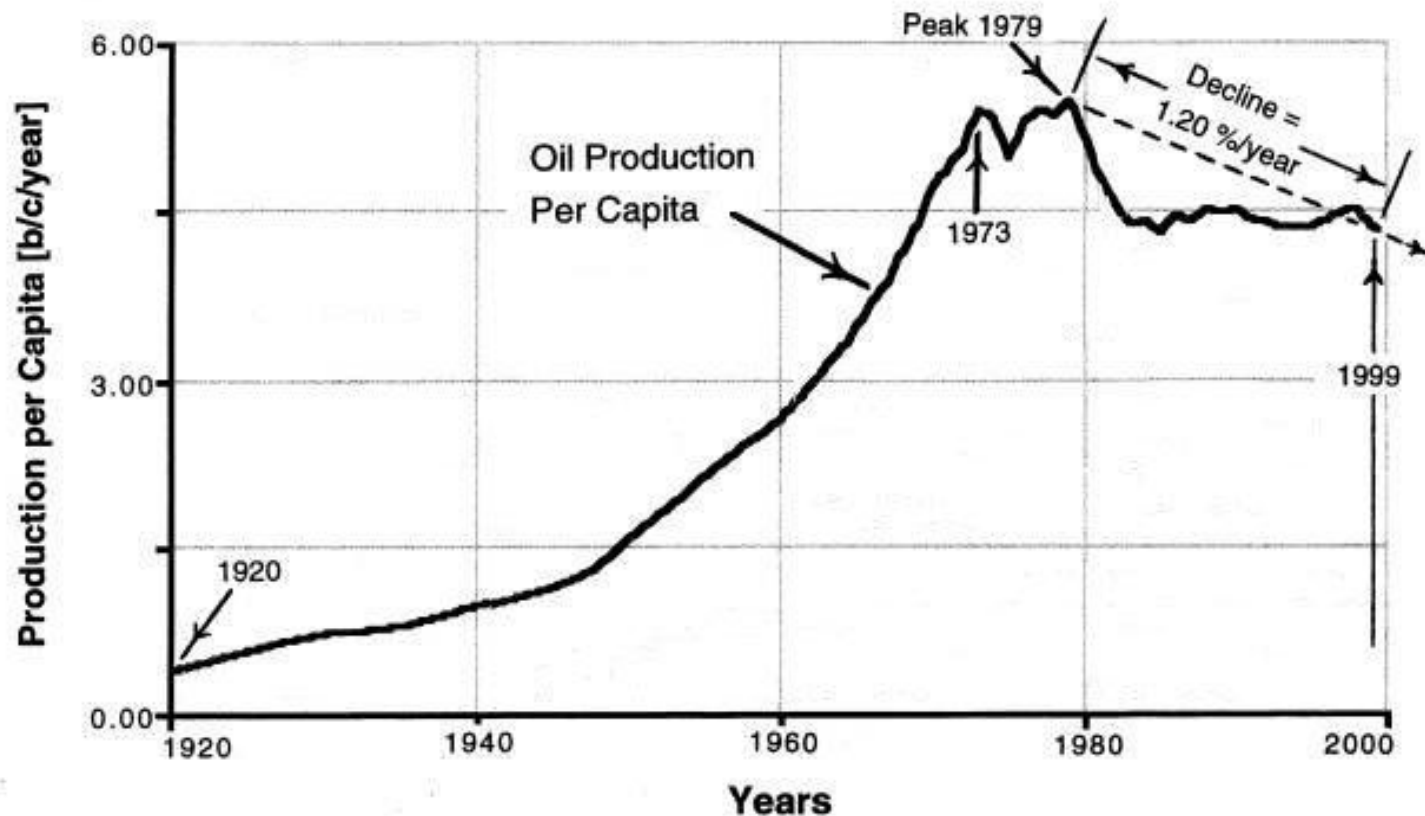
- Growth rate increased rapidly in latter half of century
- The time when oil production also increased rapidly

World Population - Perspective



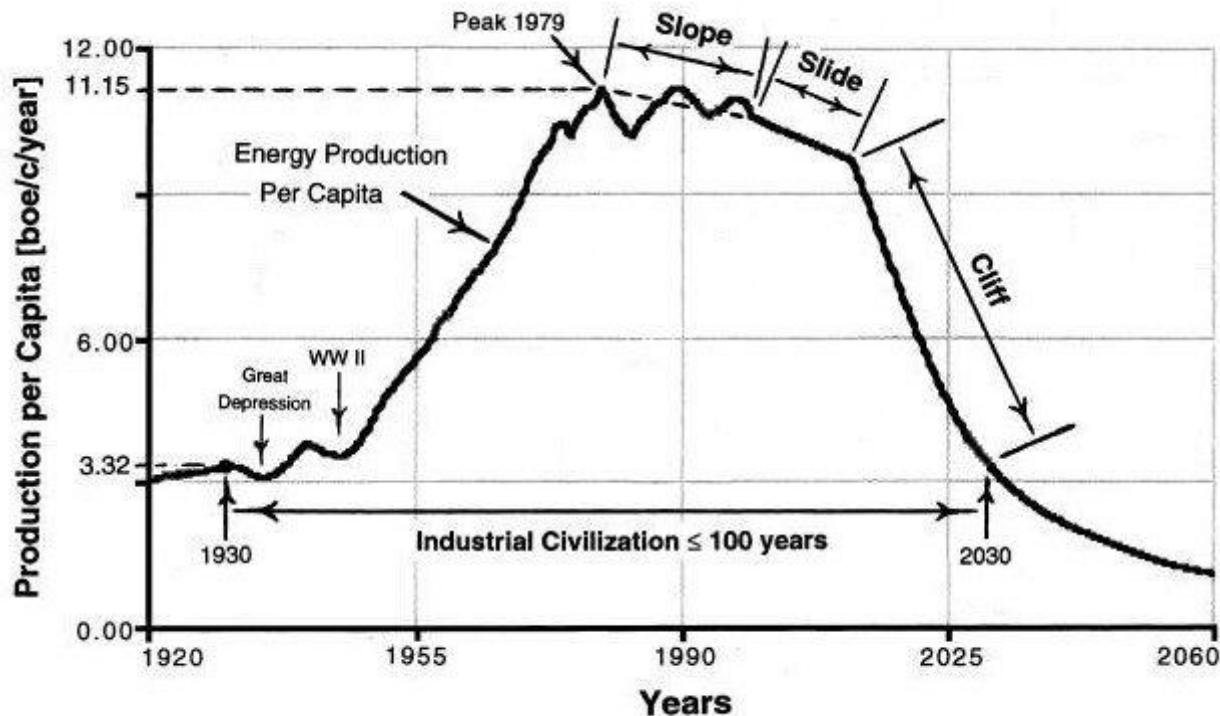
- Sustainability Explained

World Oil Production per Capita



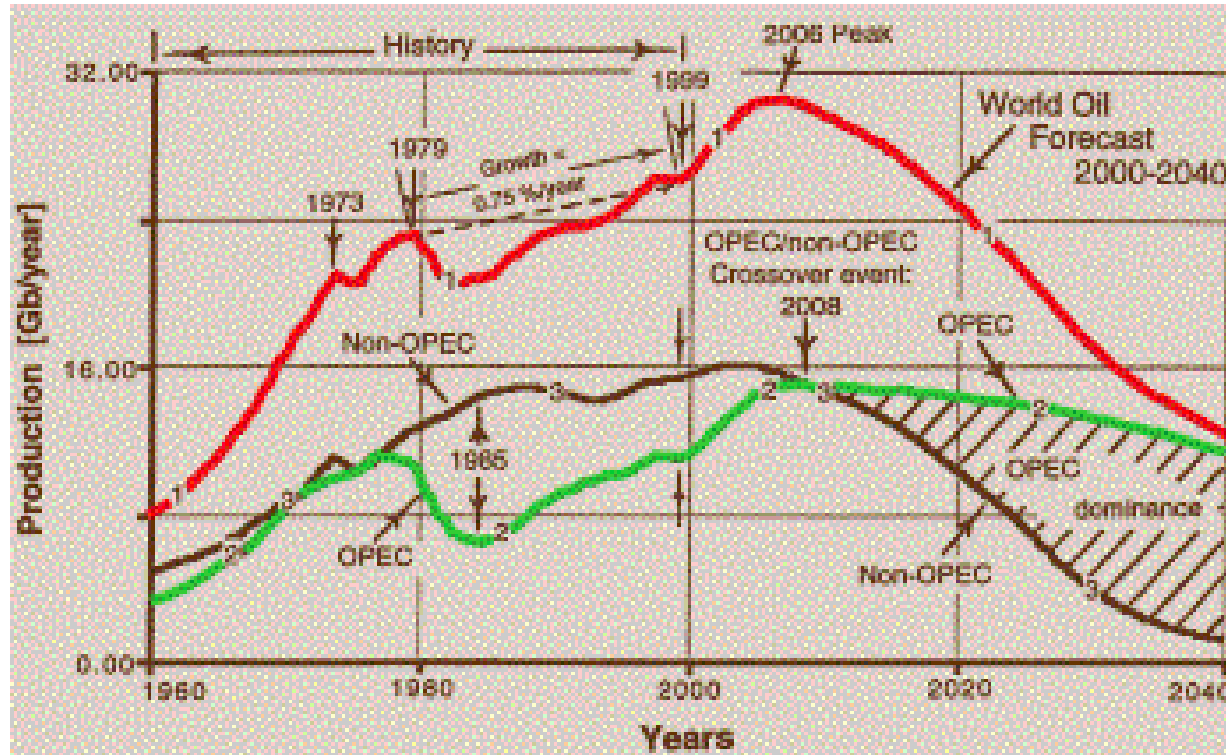
- Measured in barrels of oil per person per year (b/person/year)
- 1973 – Yom Kipper War, 1979 – Iranian Revolution

All Energy per Capita Projected Decline



- 1930 and 2030 – Energy/capita at 30% of 1979 peak value
 - 3.32 boe/person – Barrels of oil equivalent per person per year
- High Energy Civilization lifespan – about 100 years.
- Will revert to “energy” life style of 1930
- Probably will not lose scientific advances (e.g. medicine)

World Oil and the Middle East



- Line 1 – Red: Total Oil (sum of lines 2 and 3)
- Line 2 – Black: Non-OPEC oil
- Line 3 – Green: OPEC oil
- Non-OPEC oil will peak soon – OPEC will dominate

Faster Extraction Rates

- Oil reservoirs can be damaged by forcing production by injections
- Forcing the oil is harmful – i.e., injections may limit ultimate recovery
- Saudi Arabia is injecting 7 million barrels sea water daily
- Natural Gas doesn't slow down at halfway point.
 - Depletion cannot be predicted as easily

Psychology of Projections and Denial

- **Past projections attacked**

- **Threatens growth economics – people might buy small cars**
 - **Energy companies sell fuel**
 - **Car companies sell big cars**
 - **Workers don't want to get laid off.**

- **Consumerism is based on continuous growth**
 - **This implies constantly increasing energy use**

- **Denial - Public blames corporations and government**

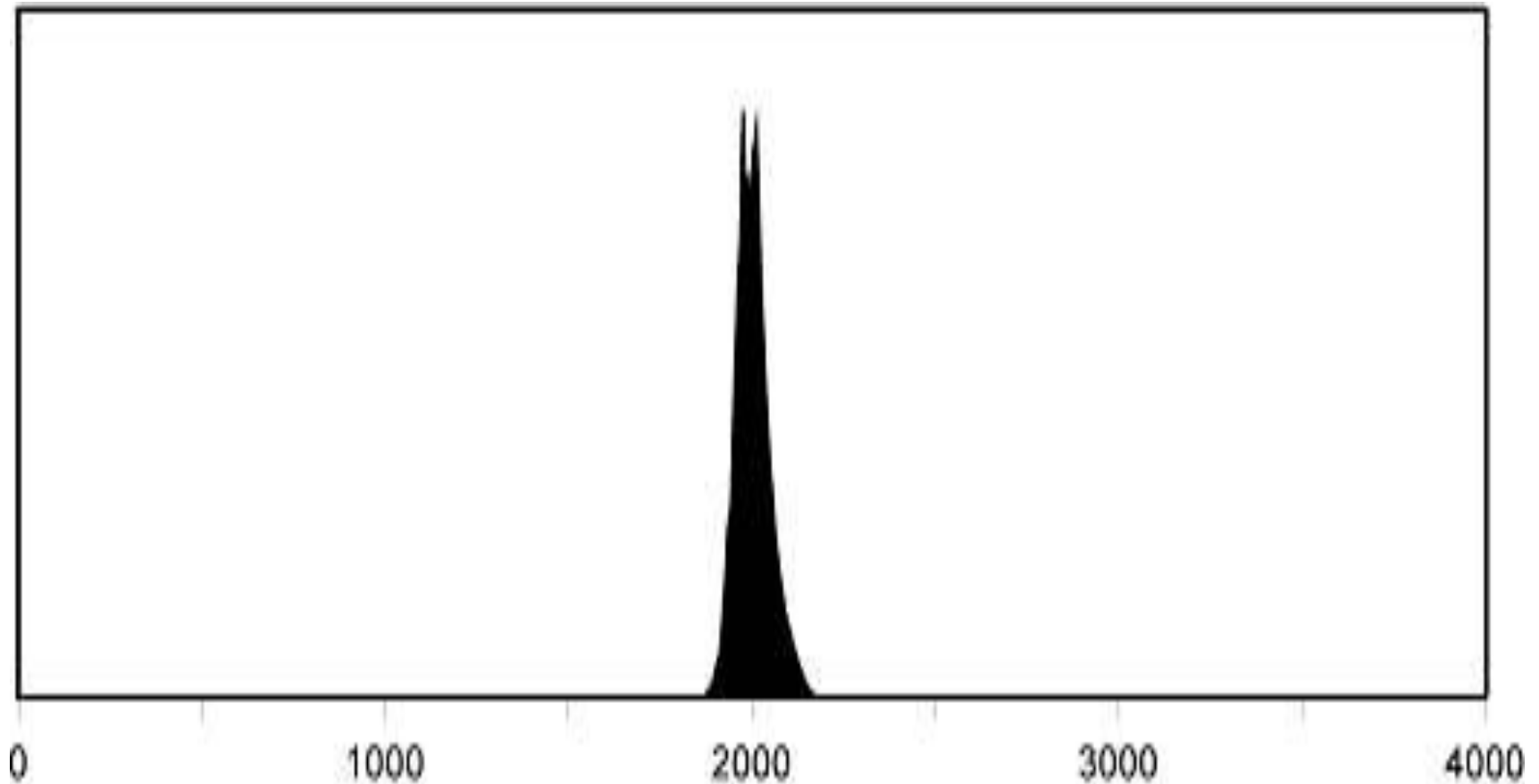
Misleading Reserves – Recent Examples

- In 2002 Canada increased reserves from 4.8 Gb to 178 Gb!
 - Arbitrarily defined oil shale as conventional oil
- Jan. 12, 2004 – Shell Oil reduced its reserves by 20%
- Jan. 14, 2004 – Wall Street Journal suggests all reserves questionable
- February, 2004 – Soviet Union declared all oil data a state secret
- Predictions become difficult

Oil Depletion Summary

- Most experts now accept the obvious: finite resources are finite.
- Predictions have been validated – Exxon Mobil, BP, and others agree.
- People are becoming aware – outside U.S. most of world thinks -
 - “Iraq is about oil”
- Good books appearing
 - The Long Emergency – (Kunstler, 2005)
 - The End of Oil – (Roberts 2004)
 - Out of Gas – The End of the Age of Oil (Goodstein, 2004)
 - The Party’s Over – (Heinburg, 2003)
 - Hubbert’s Peak – (Deffeyes, 2001)
 - The Coming Oil Crisis – (Campbell, 1997)
- “Running Out” is not the immediate issue.

Is this the Energy Curve of History?



Obstacles to Overcome

- **Harmful ideas**
 - **Our planet has infinite resources.**
 - **The market will create a replacement.**
 - **The current US standard of living is a right.**
 - **The current US standard of living is desirable.**
 - **Technology will save us.**
 - **By the time we run out, we will find another source of energy.**

What's the Ultimate Solution?

- **A change of heart (or a new species)**
- **Need for extreme energy curtailment**
- **Beginning of cooperative sustainable man**
 - **The philosophy needed to make the change**
 - **Cooperative and sustainable**

Changes Ahead... What Is Going To Happen?

- Lack of oil implies a huge societal change.
- What will these changes be?

Mankind's Huge Challenge

- **Must adapt our way of life to use less oil and gas by**
 - **Being much less wasteful**
 - **Using substitute sources of energy**
 - **Problem: none close to oil in terms of cost and convenience.**

The Future: The Consequences

■ Agriculture

- “Virtually all of the processes in the modern food system are now dependent upon [oil], which is nearing its depletion phase.”

<http://www.countercurrents.org/po-church0700405.htm>

- “It has been estimated that the CO2 emissions attributable to producing, processing, packaging and distributing the food consumed by a family of four is about 8 [additional] tonnes a year.”

Food

- Beef requires 54 calories of energy to produce 1 calorie of food. (1997 data).
- Most grains require 3 calories of energy for 1 calorie of food.
- Food in the US travels approximately 1500 miles to your table.