

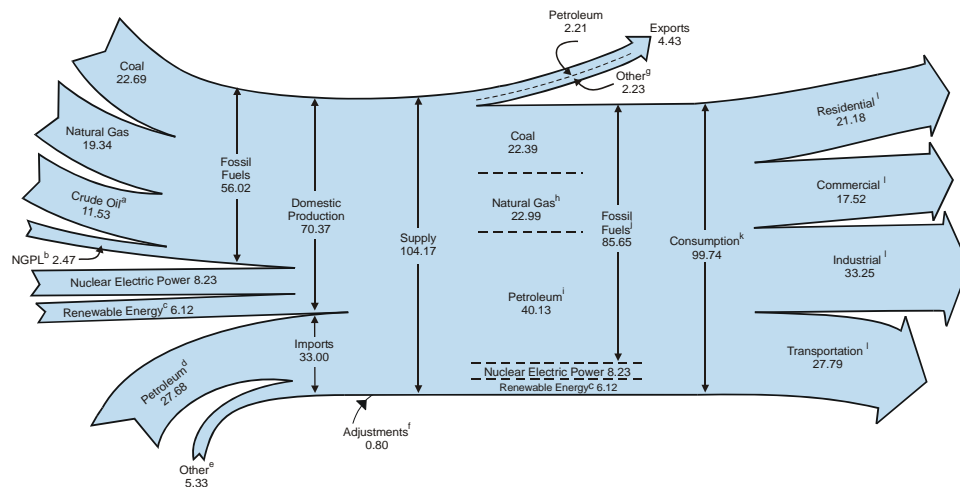
The Human Earth (MAE 124/ESYS 103)

Lecture 9

Energy

Energy inputs and outputs (US)

Diagram 1. Energy Flow, 2004
(Quadrillion Btu)



^a Includes lease condensate.

^b Natural gas plant liquids.

^c Conventional hydroelectric power, wood, waste, ethanol blended into motor gasoline, geothermal, solar, and wind.

^d Crude oil and petroleum products. Includes imports into the Strategic Petroleum Reserve.

^e Natural gas, coal, coal coke, and electricity.

^f Stock changes, losses, gains, miscellaneous blending components, and unaccounted-for supply.

^g Coal, natural gas, coal coke, and electricity.

^h Includes supplemental gaseous fuels.

ⁱ Petroleum products, including natural gas plant liquids.

^j Includes 0.14 quadrillion Btu of coal coke net imports.

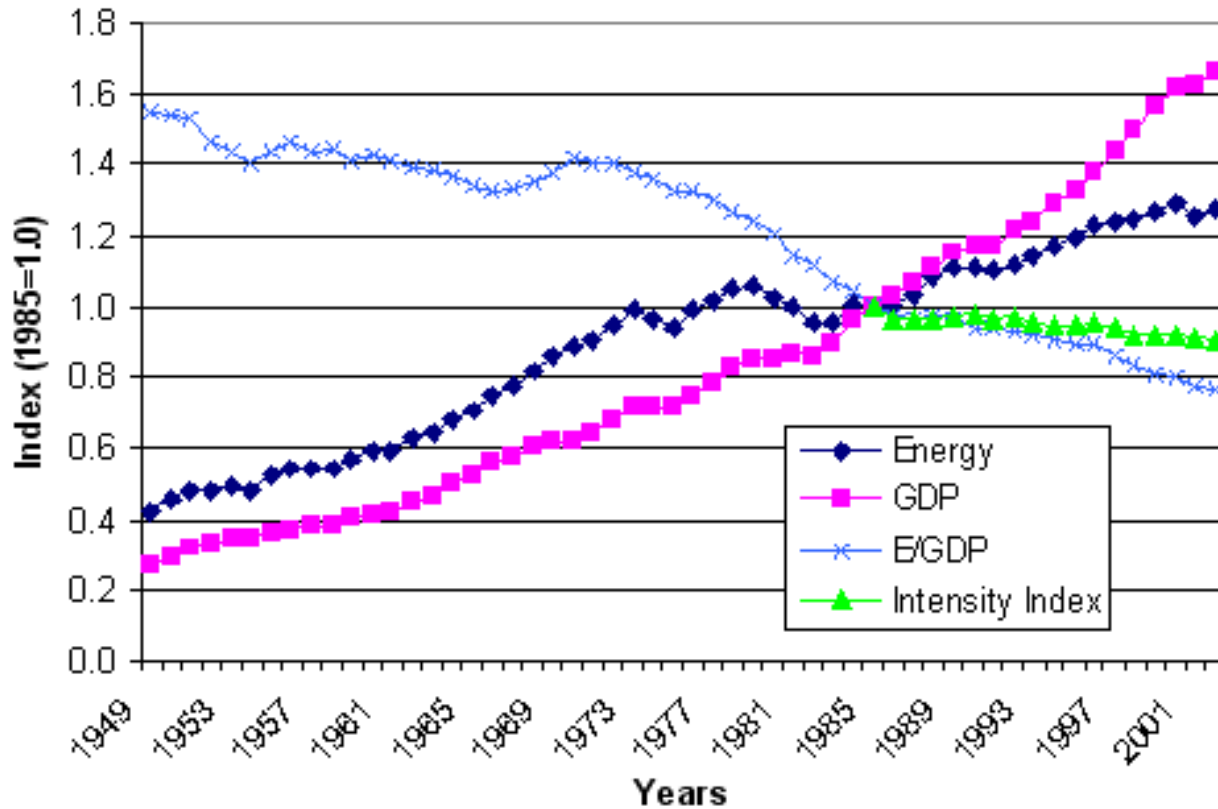
^k Includes, in quadrillion Btu, 0.30 ethanol blended into motor gasoline, which is accounted for in both fossil fuels and renewable energy but counted only once in total consumption; and 0.04 electricity net imports.

^l Primary consumption, electricity retail sales, and electrical system energy losses, which are allocated to the end-use sectors in proportion to each sector's share of total electricity retail sales. See Note, "Electrical Systems Energy Losses," at end of Section 2.

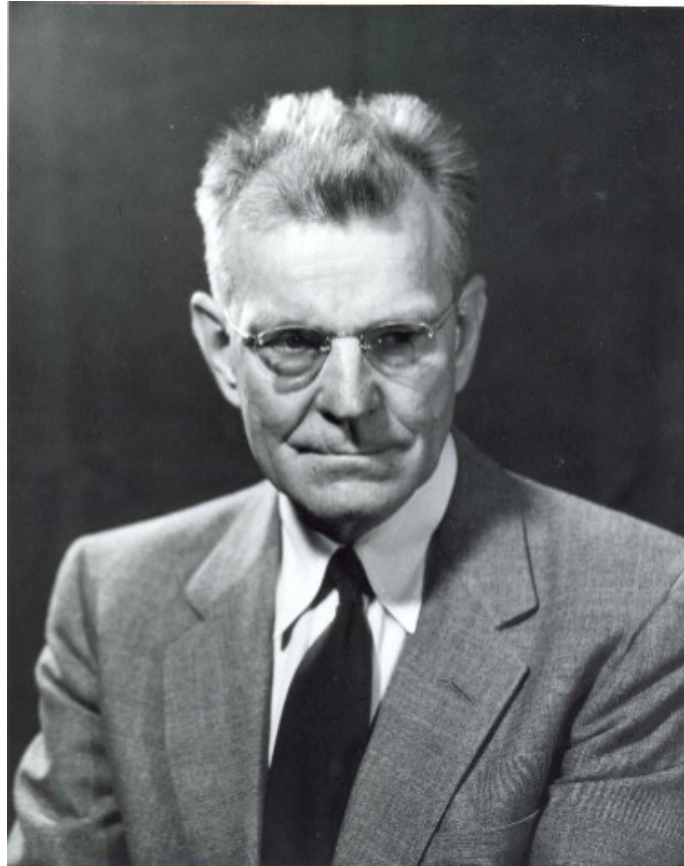
Notes: • Data are preliminary. • Totals may not equal sum of components due to independent rounding.

Sources: Tables 1.1, 1.2, 1.3, 1.4, 2.1a, and 10.1.

Energy per GDP



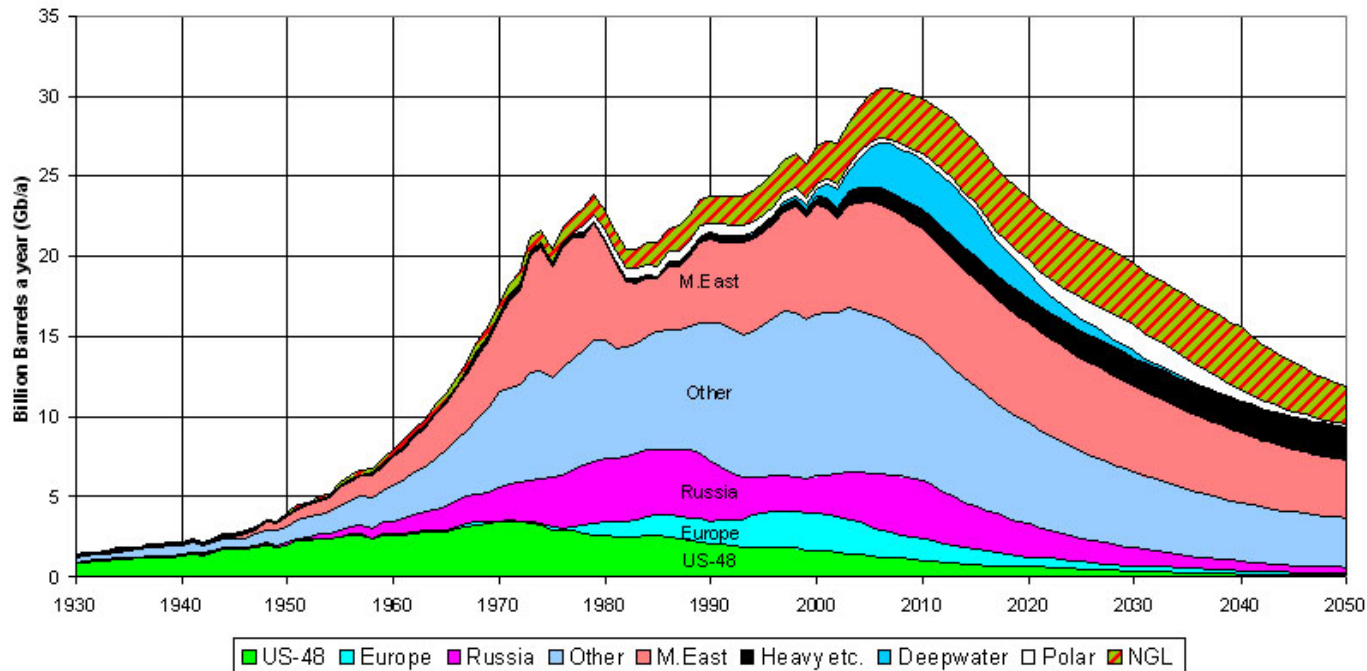
M. King Hubbert (1903-1989)



<http://www.hubbertype.com/hubbertype/>

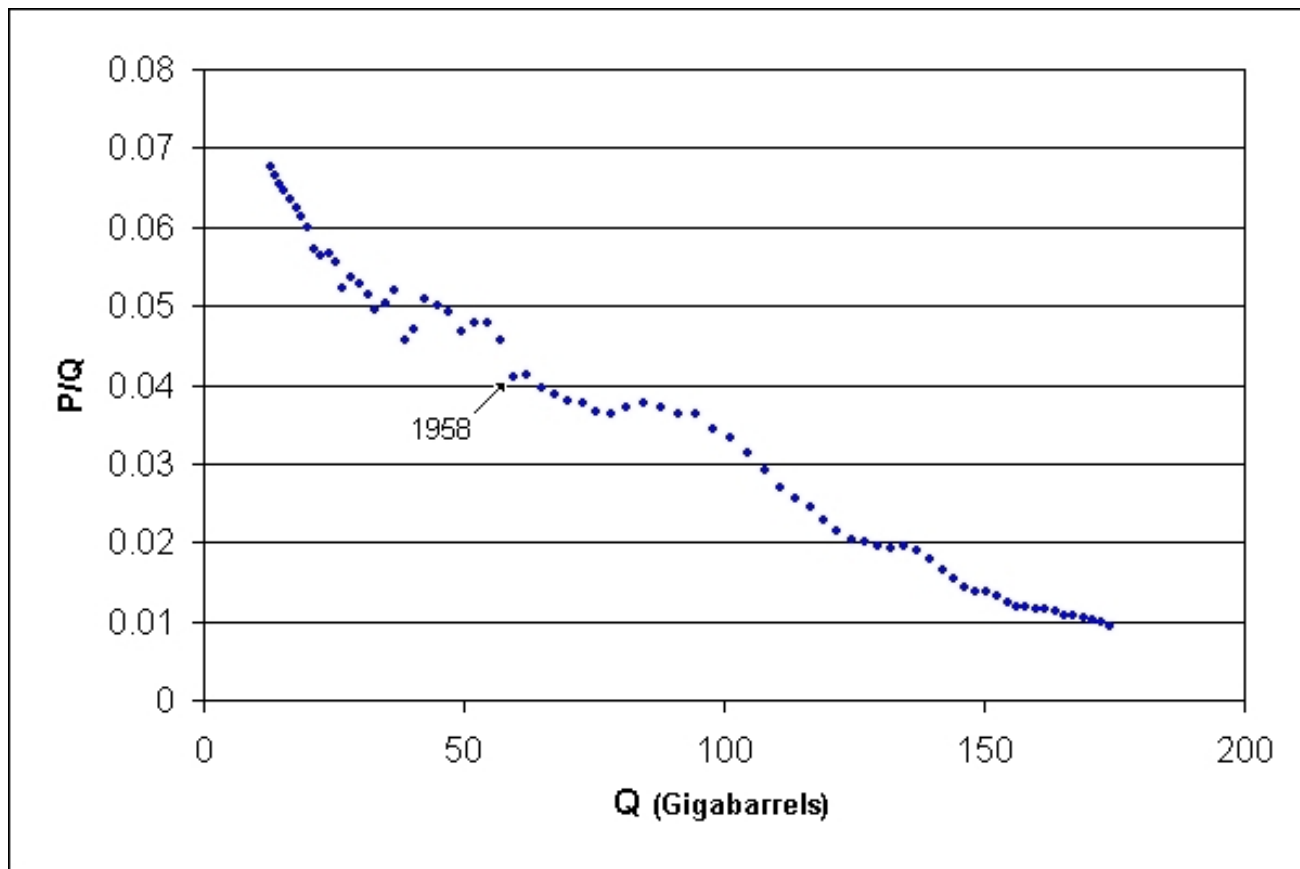
Peak Oil Forecasts

OIL AND GAS LIQUIDS 2004 Scenario

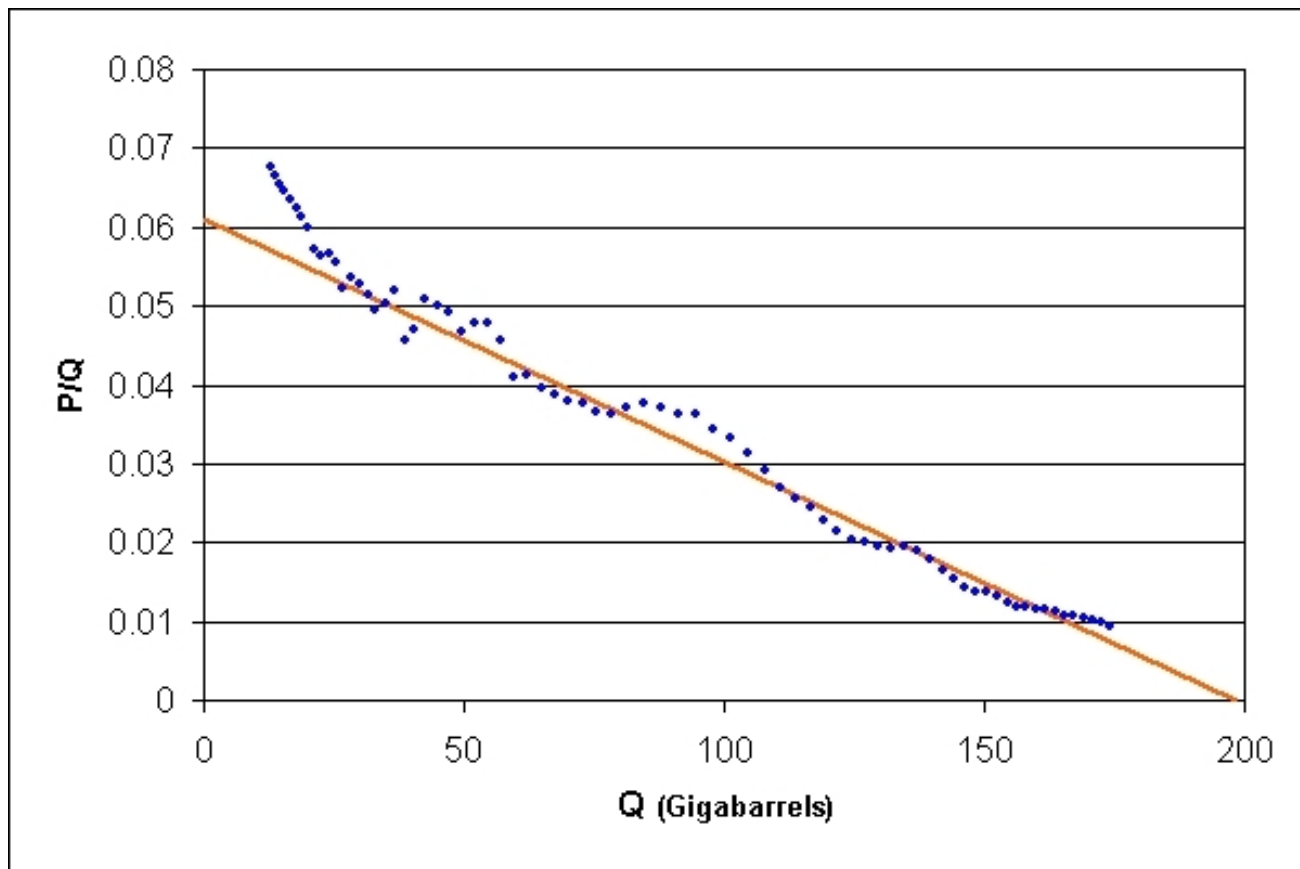


<http://www.peakoil.net/uhdsg/Default.htm>

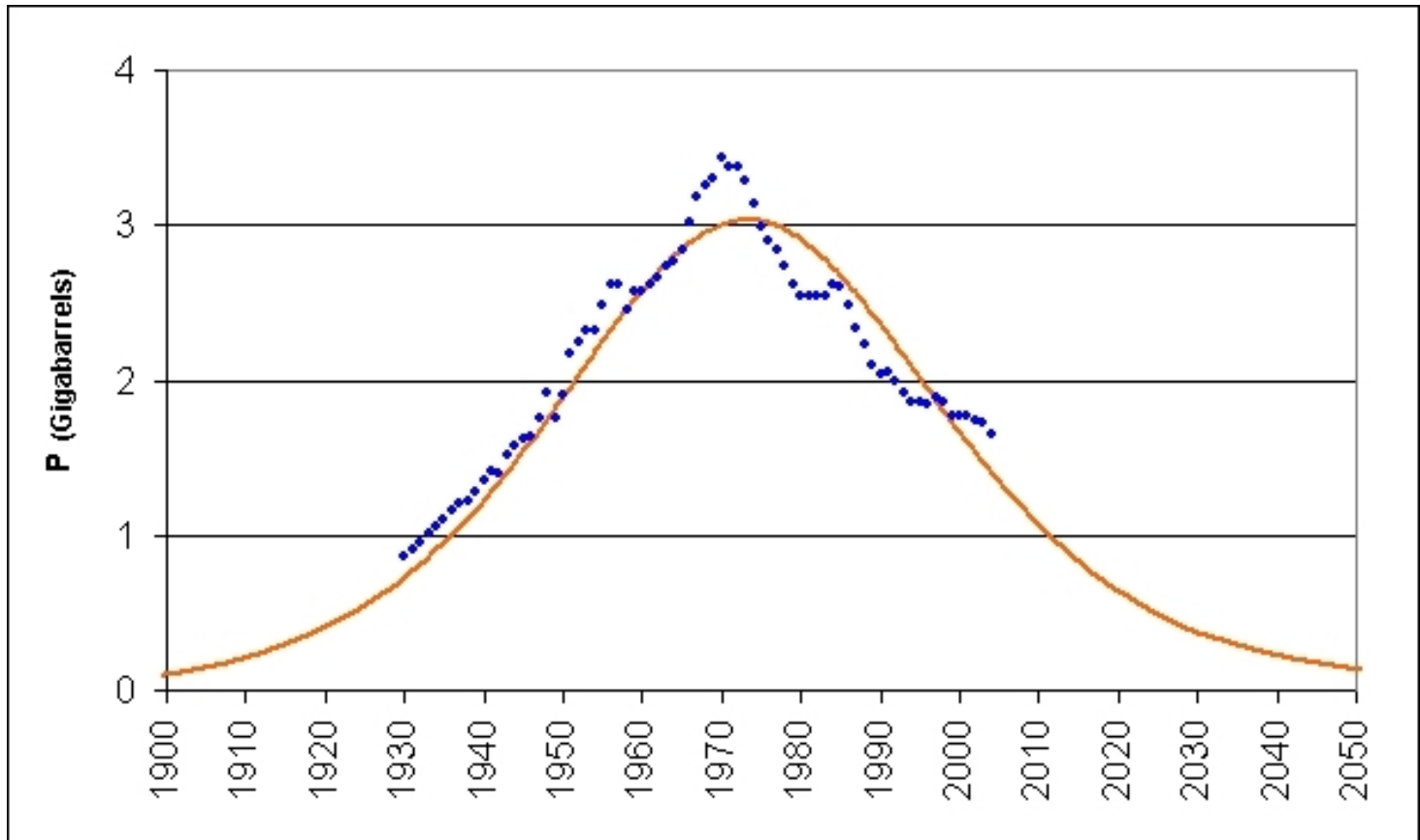
Peak Oil: Production versus Cumulative Production



Peak Oil: Production versus Cumulative Production

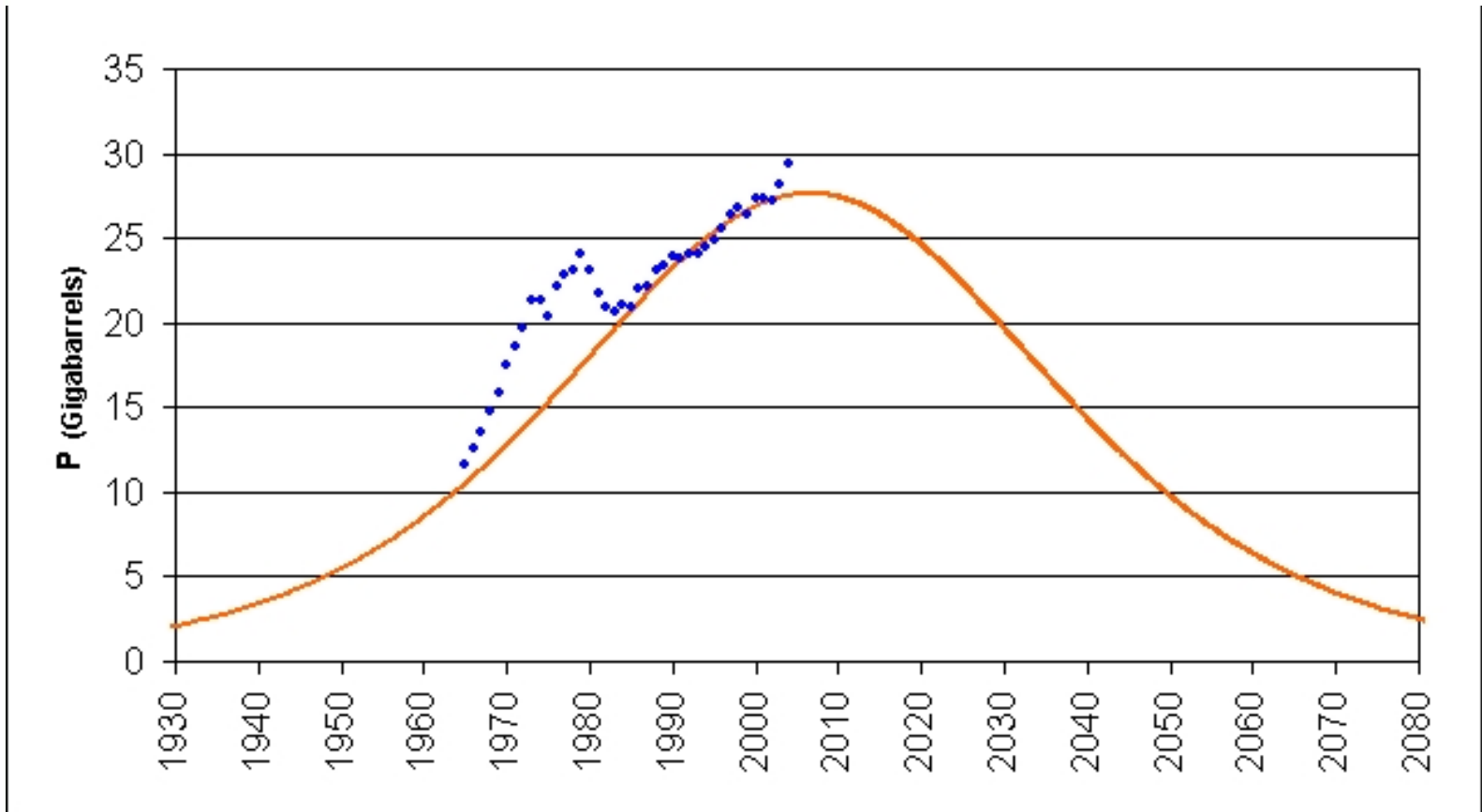


Peak Oil: US Production Peak



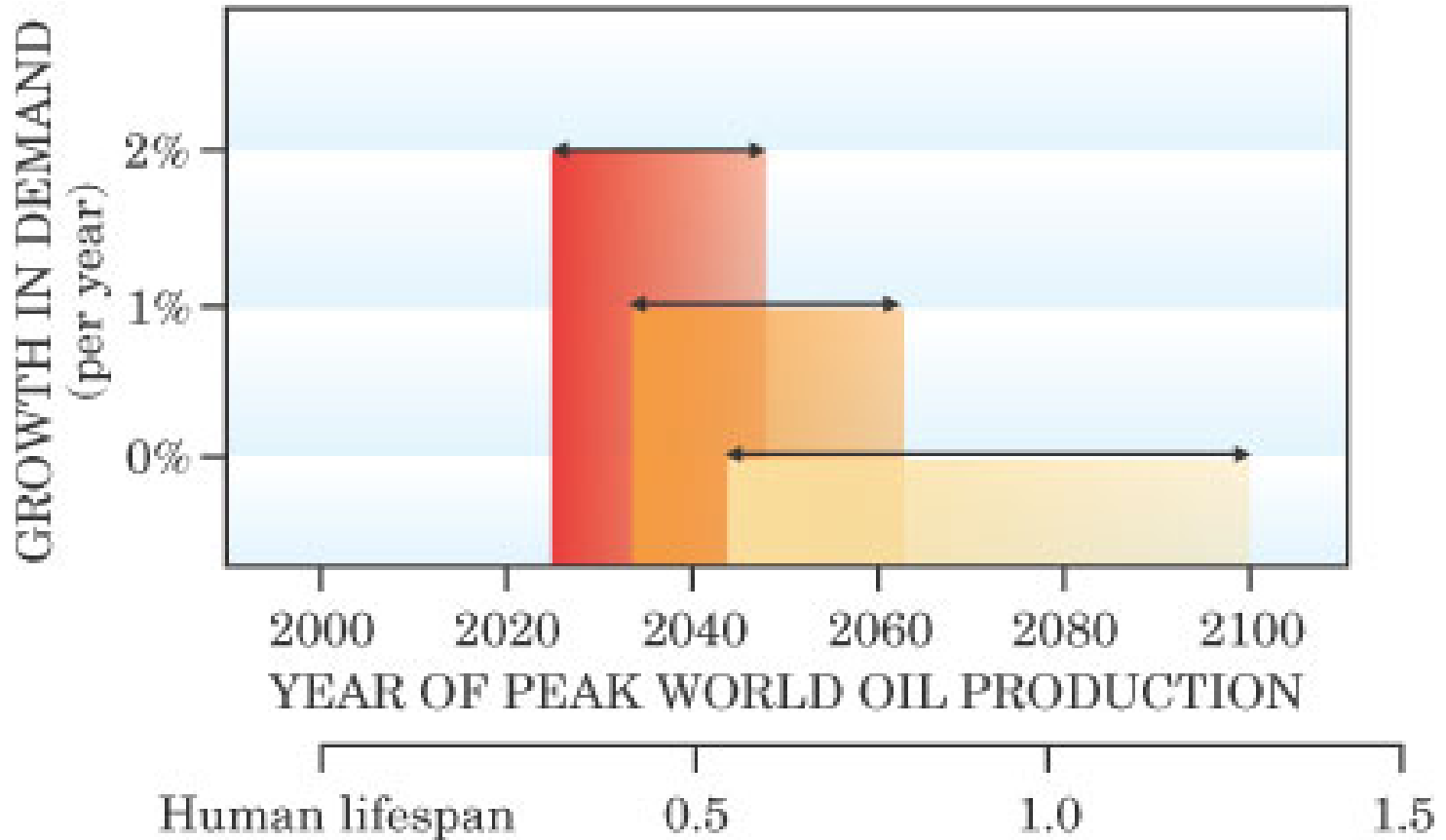
<http://wolf.readinglitho.co.uk/subpages/hubbertmaths/hubbertmaths.html>

Peak Oil: World Production Peak



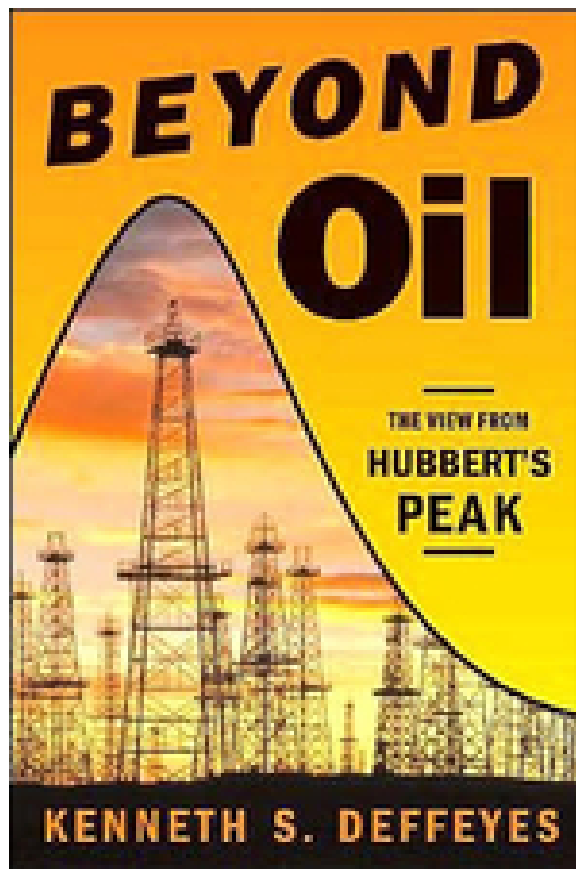
<http://wolf.readinglitho.co.uk/subpages/hubbertmaths/hubbertmaths.html>

Peak Oil: US Dept of Energy



Note: DOE assumes optimistic world oil supply. <http://www.physicstoday.org/vol-57/iss-7/p47.html>

Peak Oil: additional reading



Kenneth Deffeyes book(s)

Rising Oil Prices

<http://www.cartoonstock.com/newscartoons/directory/p/petroleum.asp>