

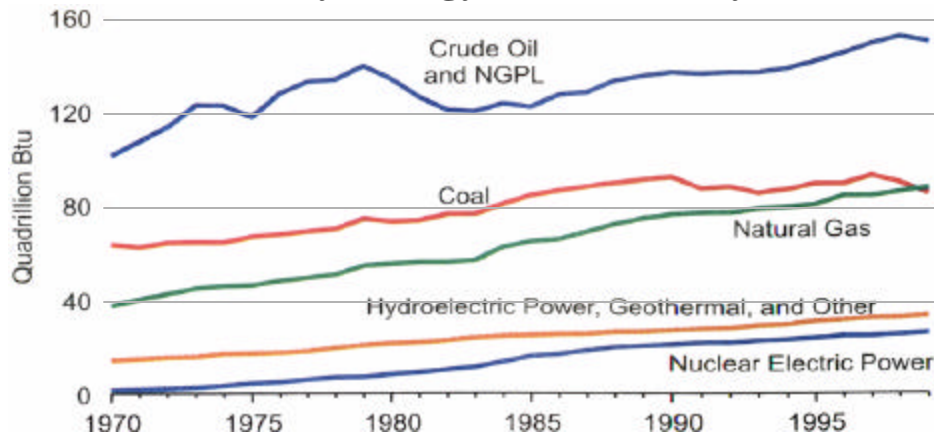


1.818J/2.65J/3.564J/10.391J/11.371J/22.811J/ESD166J
SUSTAINABLE ENERGY

Prof. Michael W. Golay
Nuclear Engineering Dept.

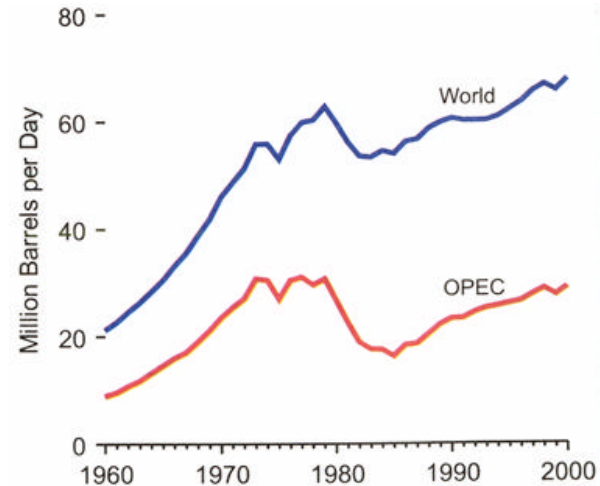
INTERNATIONAL ENERGY

World Primary Energy Production by Source



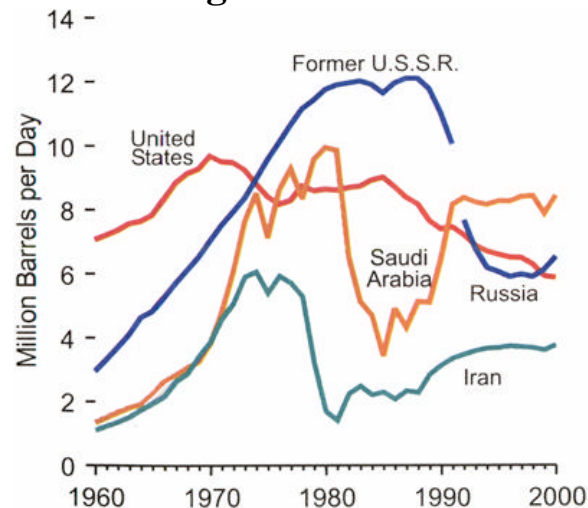
From 1970 to 1999, world primary energy production grew by 76%. Growth occurred in all types of energy. In 1999, fossil fuels accounted for 85% of all energy produced worldwide, renewable energy 9%, and nuclear power 7%.

World Crude Oil Production



World crude oil production reach a record 68 million barrels per day in 2000. OPEC's share fell from 55% in 1973 to 43% in 2000.

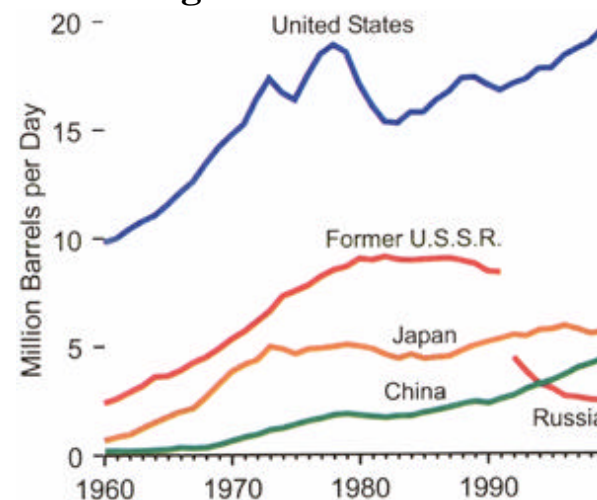
Leading Crude Oil Producers



After 1991, Saudi Arabia was the largest producer. U.S. production peaked in 1970. Russia's production surpassed U.S. output in 1999 and 2000.

OPEC = Organization of Petroleum Exporting Countries.

Leading Petroleum Consumers

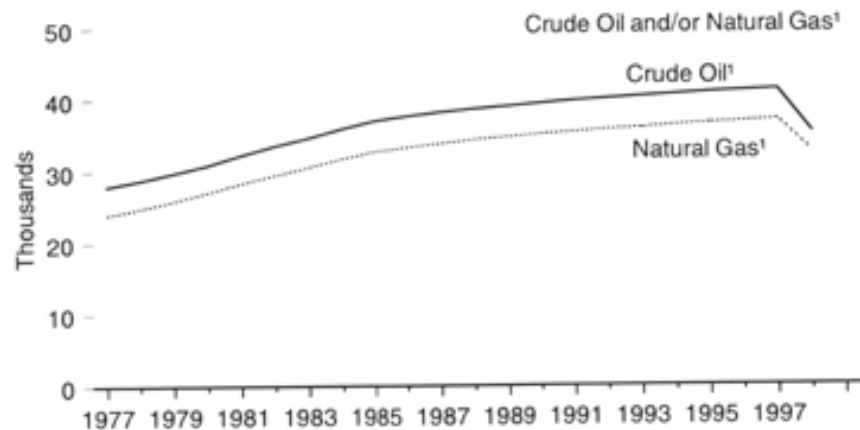


The U.S. accounted for 26% of world consumption of petroleum in 1999. Japan and China accounted for 7% and 6%, respectively.

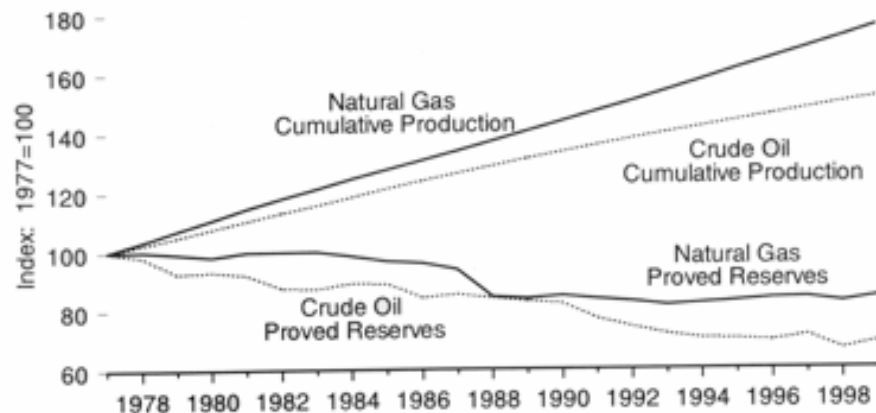
Annual Energy Review, 2000, DOE/EIA-0384(2000), Aug 2001.

CRUDE OIL AND NATURAL GAS FIELD COUNTS, CUMULATIVE PRODUCTION, PROVED RESERVES, AND ULTIMATE RECOVERY

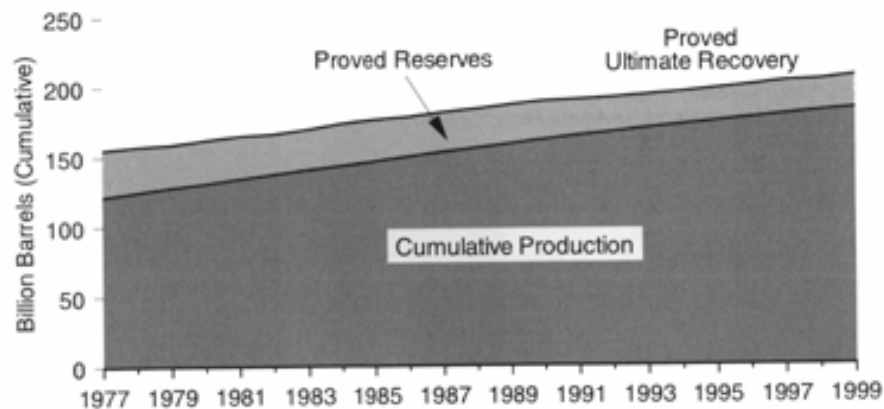
Cumulative Number of Fields, 1977-1998



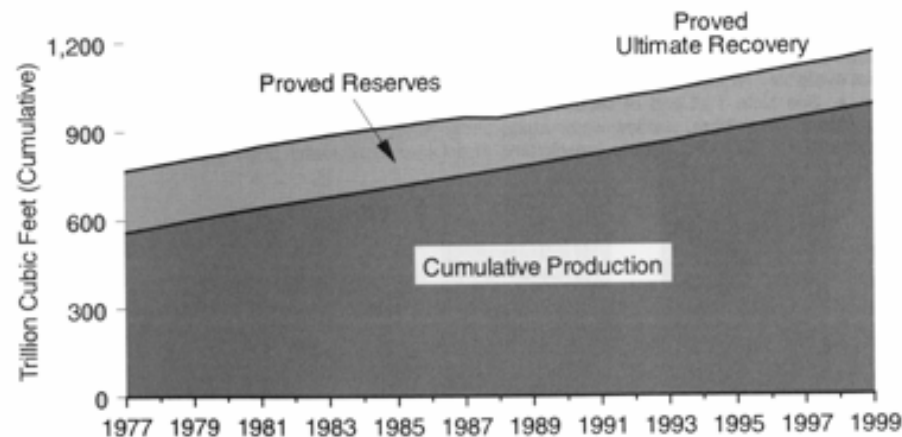
Cumulative Production and Proved Reserves, Indexed, 1977-1999



Crude Oil, 1977-1999



Natural Gas, 1977-1999



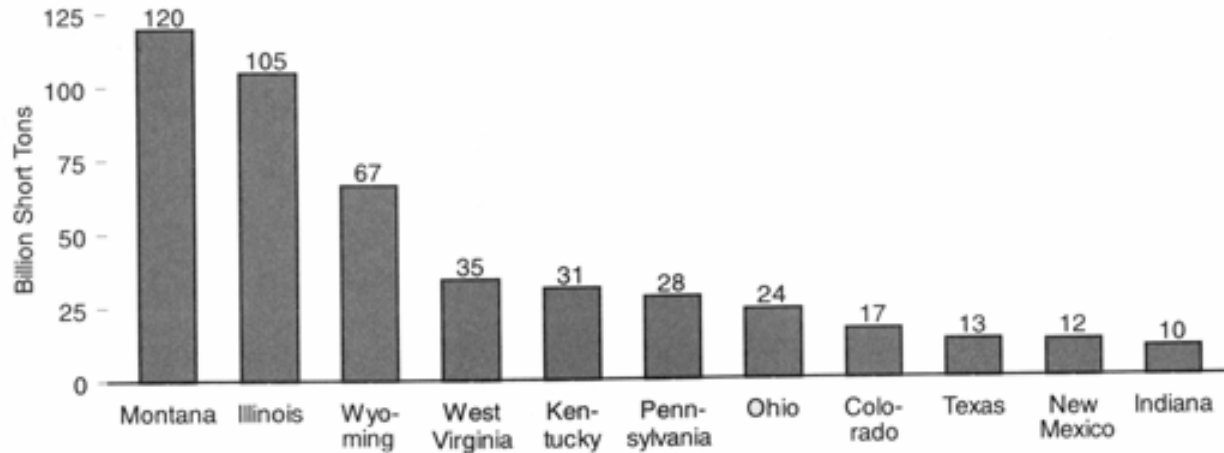
¹ There is a discontinuity in this time series between 1997 and 1998 due to the absence of updates for a subset of the data used in the past.

Notes: • Data are at end of year. • Crude oil includes lease condensate. • Natural gas is wet, after lease separation.

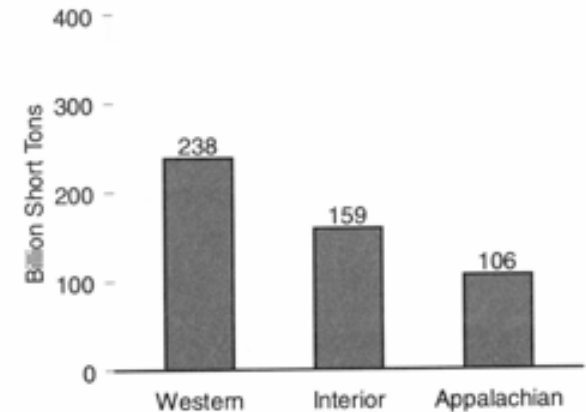
Source: Table 4.2.

COAL DEMONSTRATED RESERVE BASE, JANUARY 2, 2000

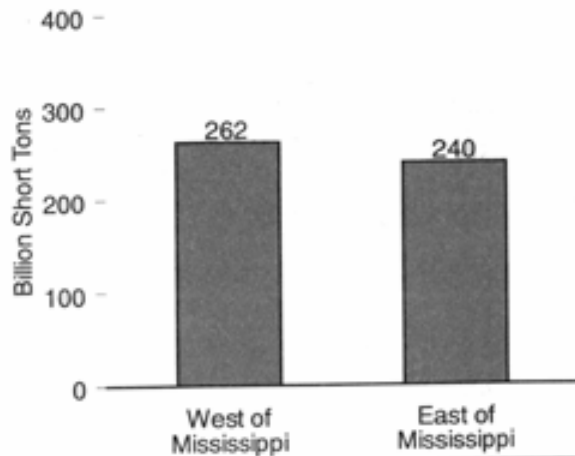
By Key State



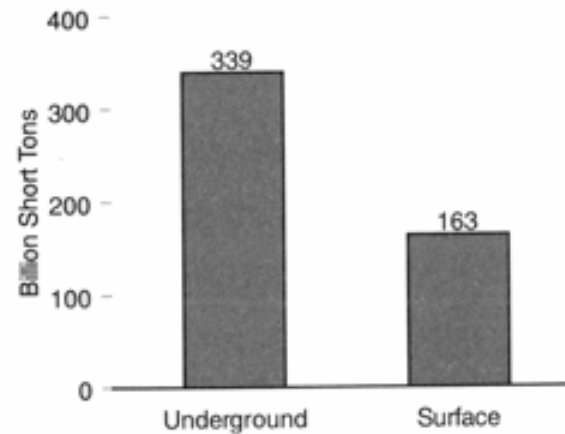
By Region



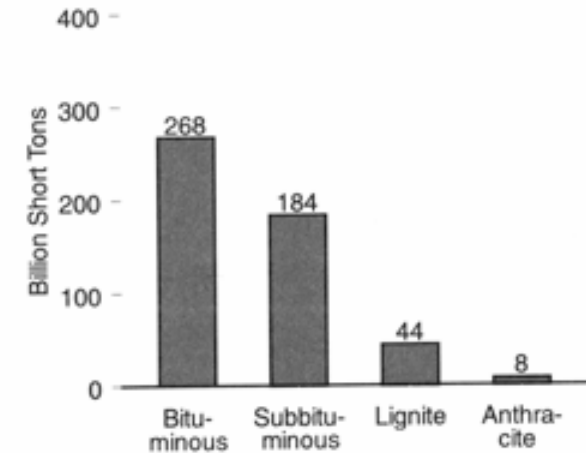
West and East of Mississippi



By Mining Method



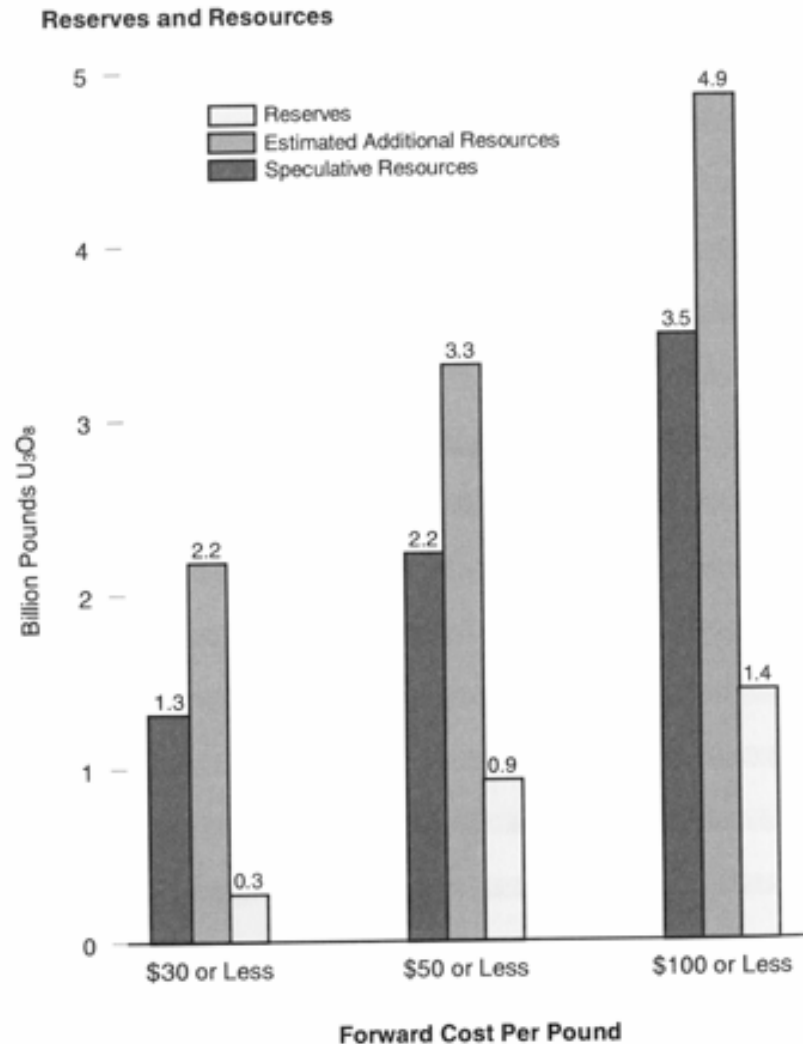
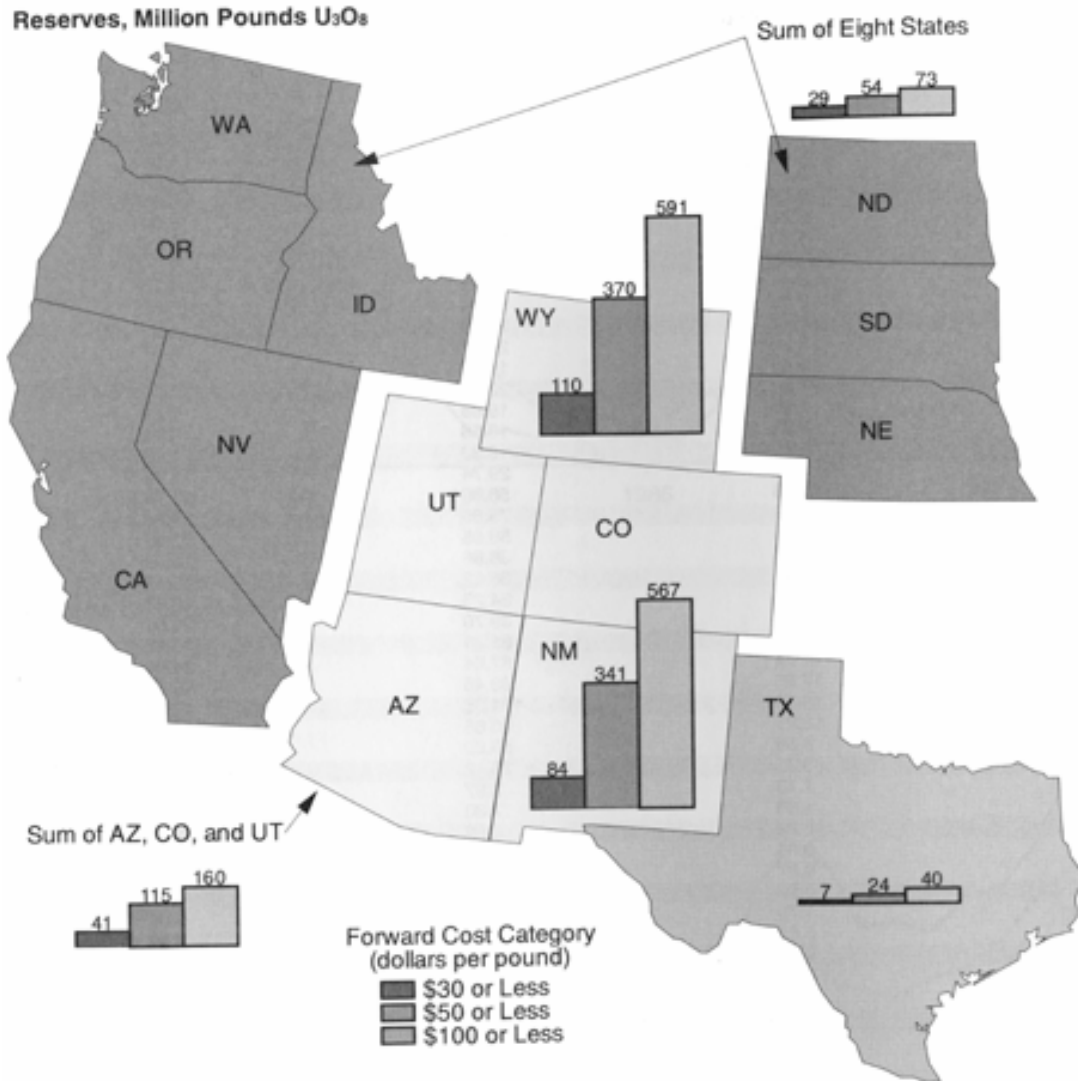
By Rank



Note: Because vertical scales differ, graphs should not be compared.

Source: Table 4.11.

URANIUM RESERVES AND RESOURCES, 2000

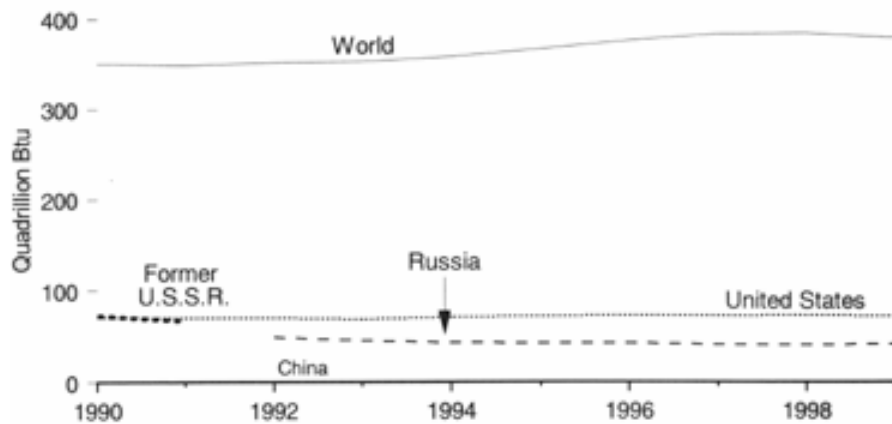


Notes: • Data are at end of year. • States shaded by group correspond to categories listed under "Reserves" on Table 4.13.

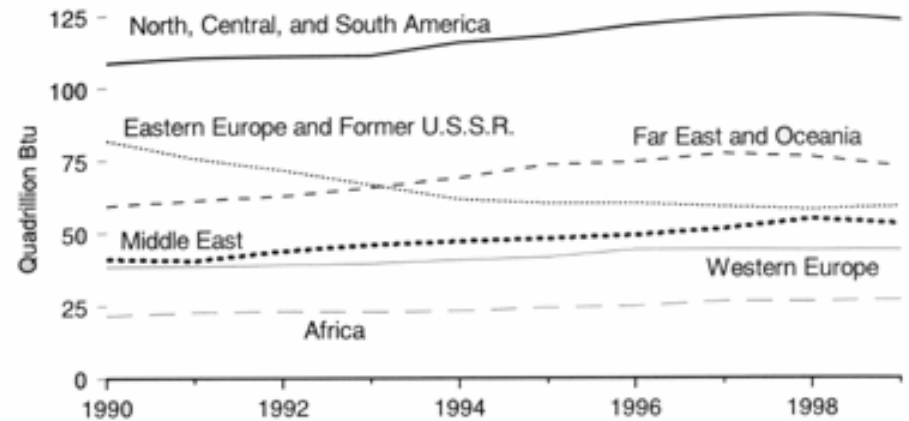
Source: Table 4.13.

WORLD PRIMARY ENERGY PRODUCTION

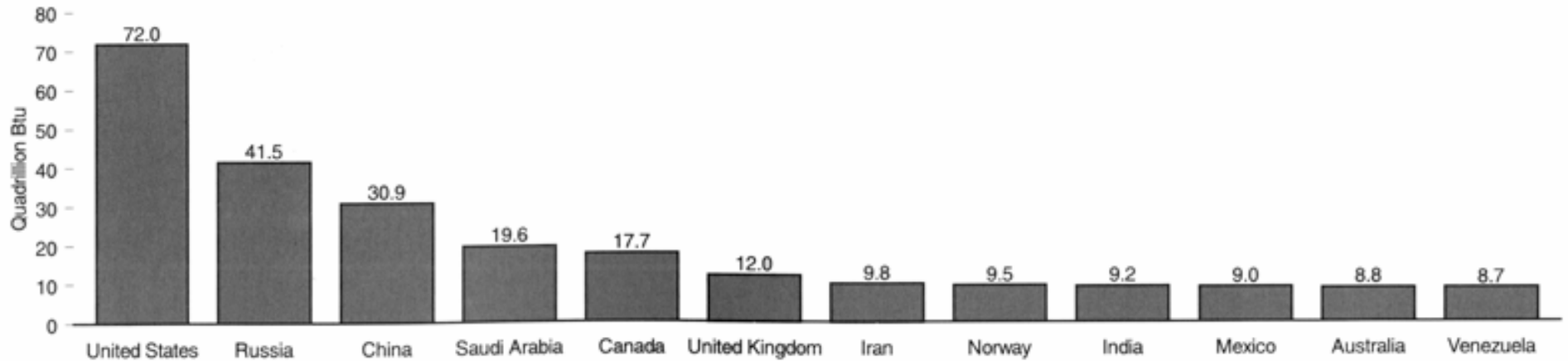
World and Leading Producers, 1990-1999



World Areas, 1990-1999



Top Producing Countries, 1999

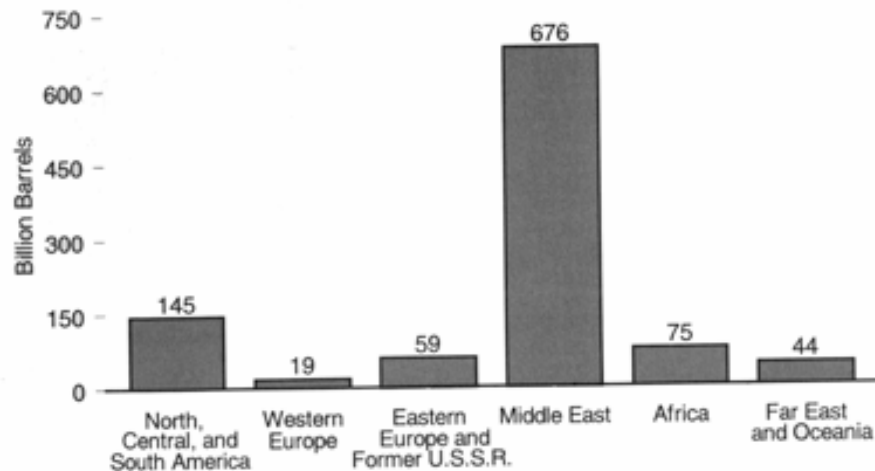


Note: Because vertical scales differ, graphs should not be compared.

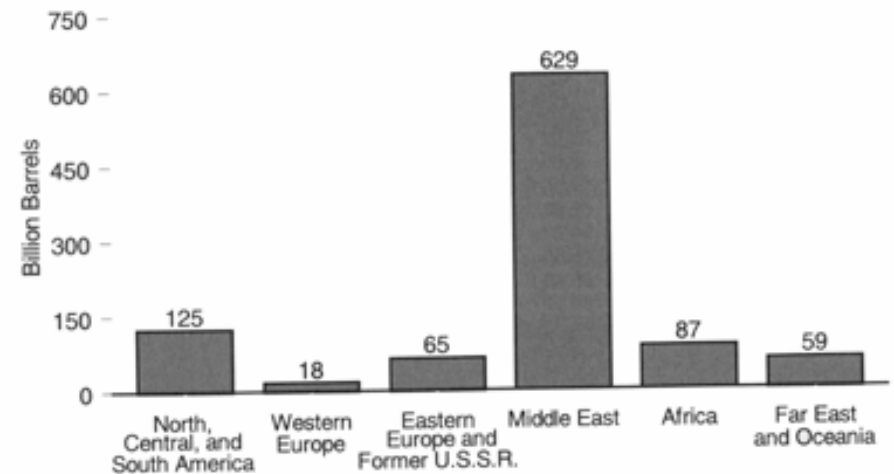
Source: Table 11.1.

WORLD CRUDE OIL AND NATURAL GAS RESERVES, JANUARY 1, 2000

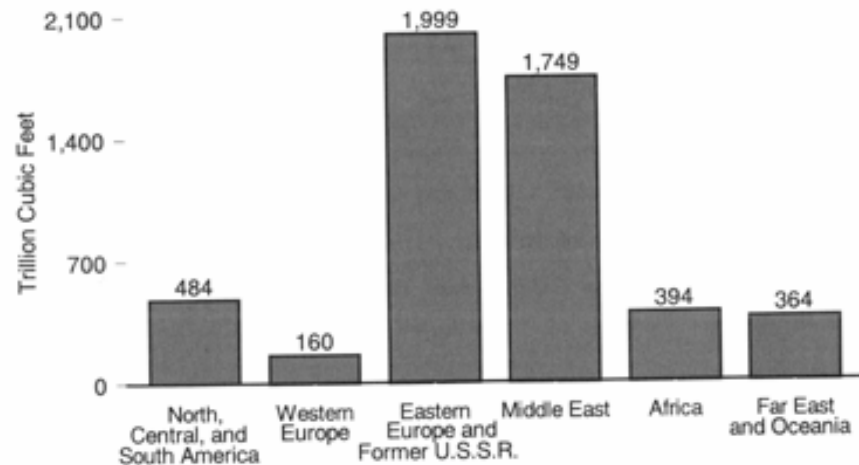
Crude Oil Reserves: *Oil and Gas Journal*



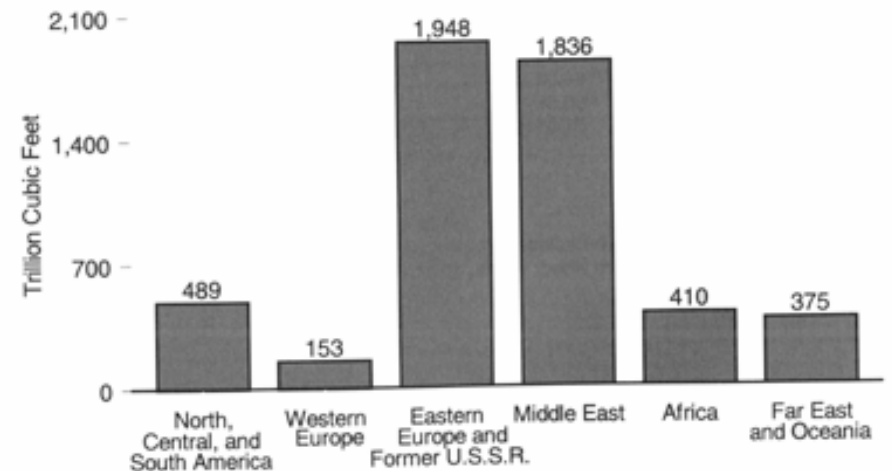
Crude Oil Reserves: *World Oil*



Natural Gas Reserves: *Oil and Gas Journal*



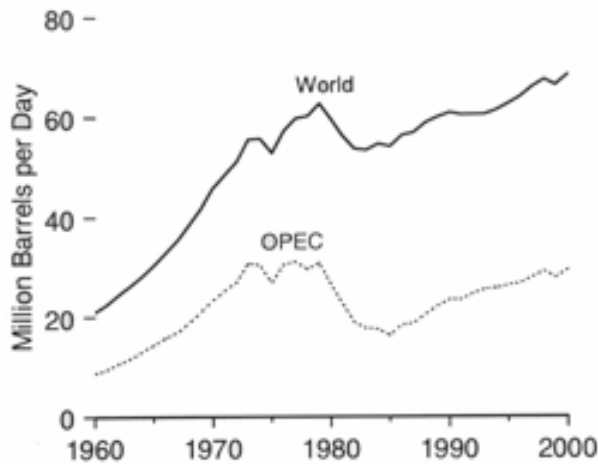
Natural Gas Reserves: *World Oil*



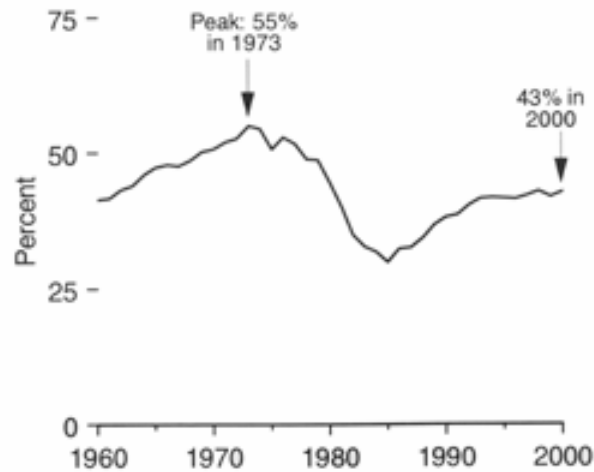
Source: Table 11.3.

WORLD CRUDE OIL PRODUCTION

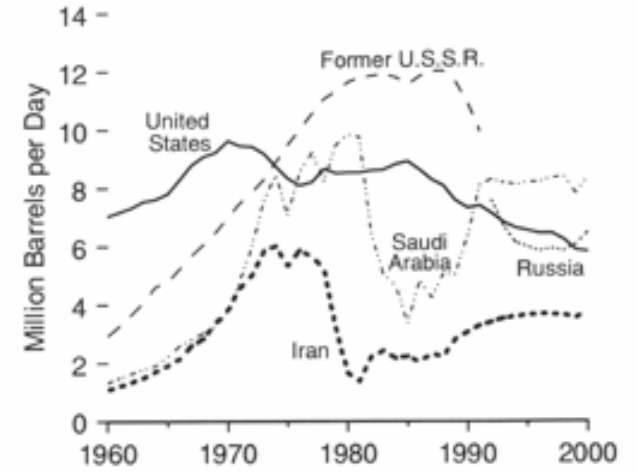
World and OPEC, 1960-2000



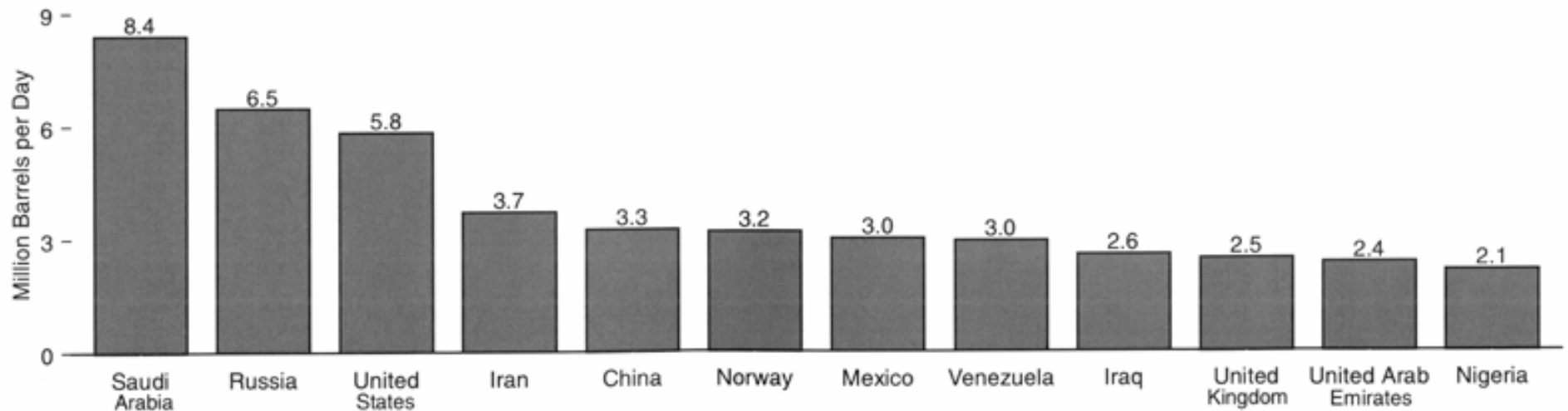
OPEC's Share of World, 1960-2000



Leading Producers, 1960-2000



Selected Producing Countries, 2000

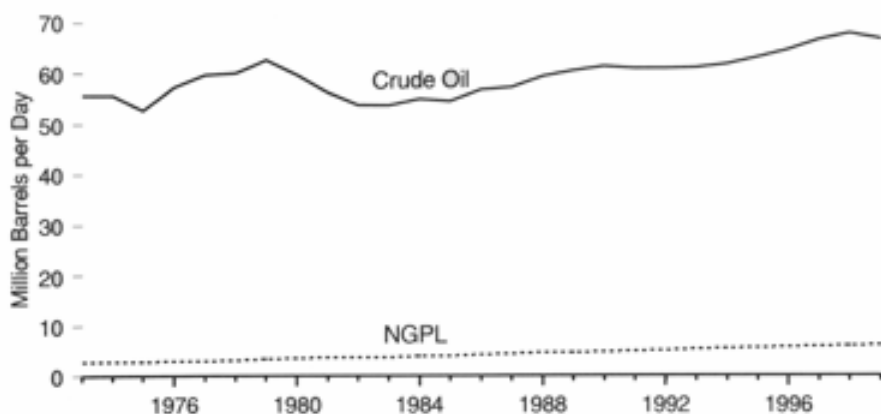


Note: Because vertical scales differ, graphs should not be compared.

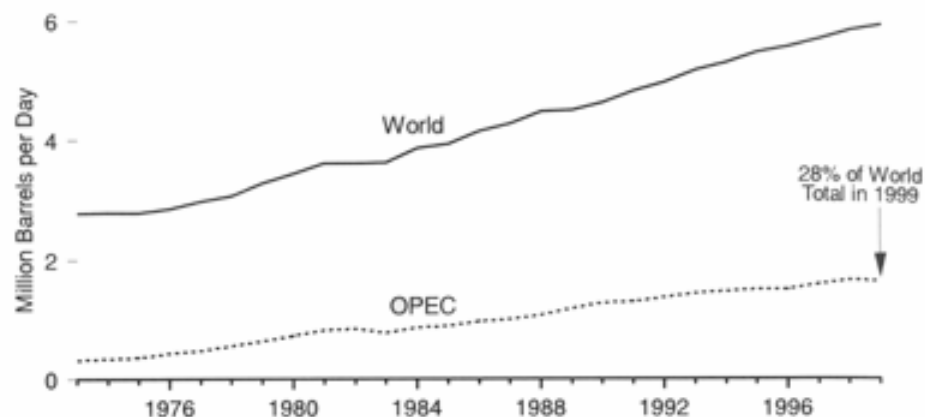
Source: Table 11.4.

WORLD NATURAL GAS PLANT LIQUIDS PRODUCTION

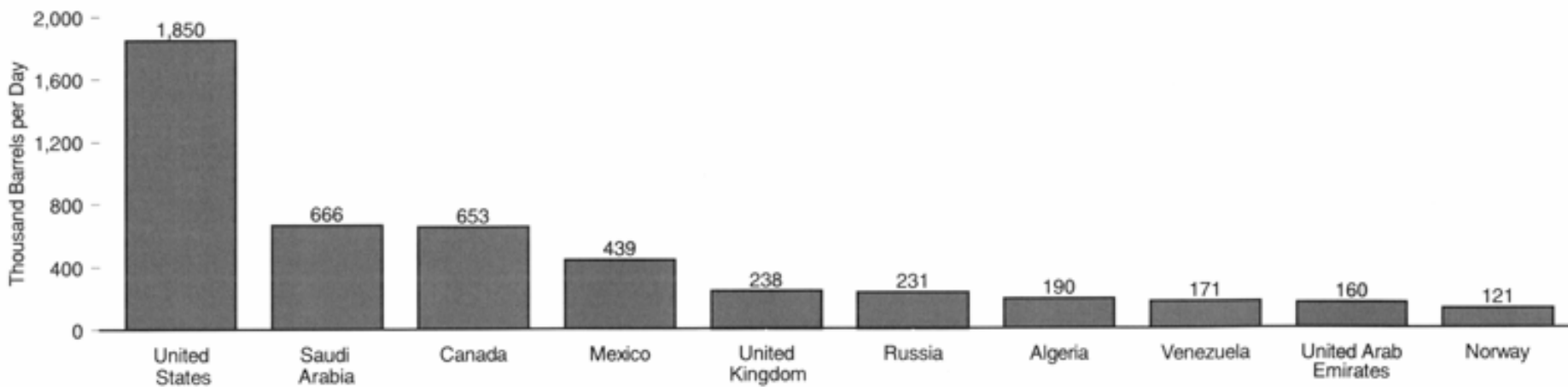
Crude Oil and NGPL Production, 1973-1999



World and OPEC NGPL Production, 1973-1999



Top NGPL Producing Countries, 1999

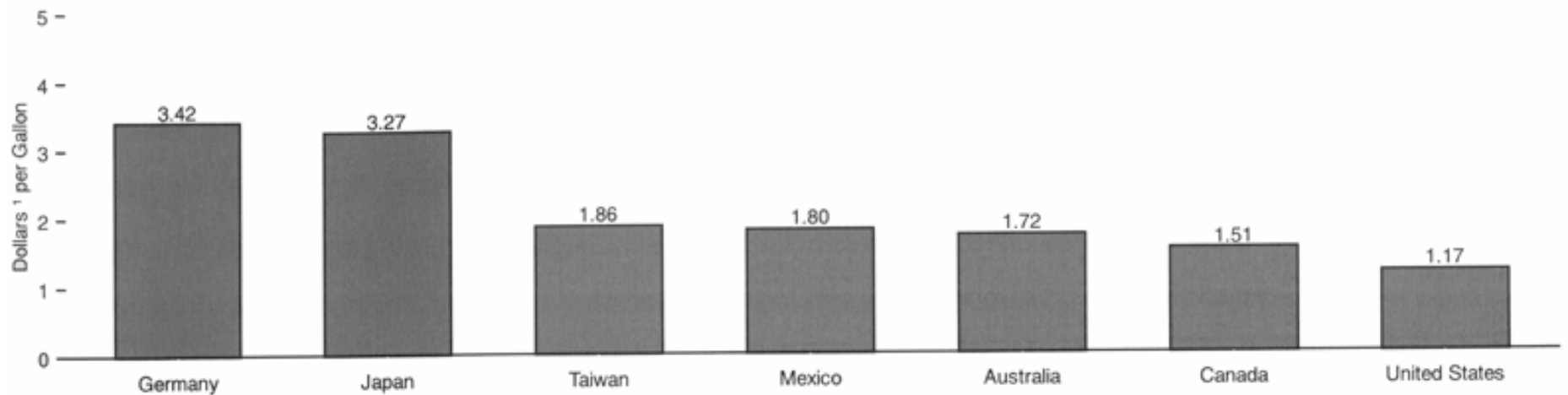


Notes: • Crude oil includes lease condensate. • NGPL is natural gas plant liquids.
 • Because vertical scales differ, graphs should not be compared.

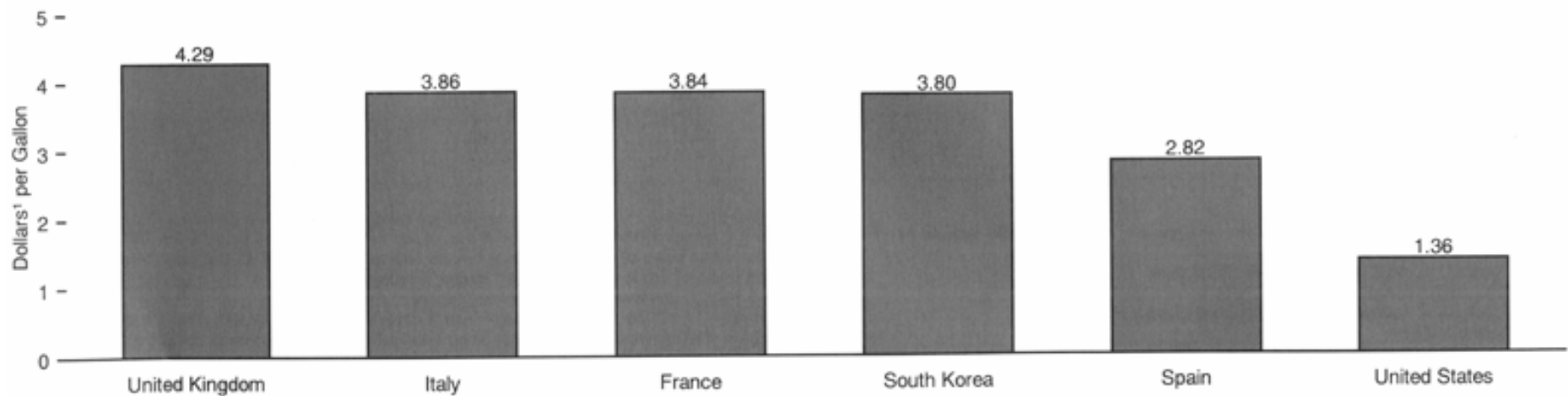
Sources: Tables 11.4 and 11.5.

RETAIL MOTOR GASOLINE PRICES IN SELECTED COUNTRIES, 1999

Regular Unleaded



Premium Unleaded²



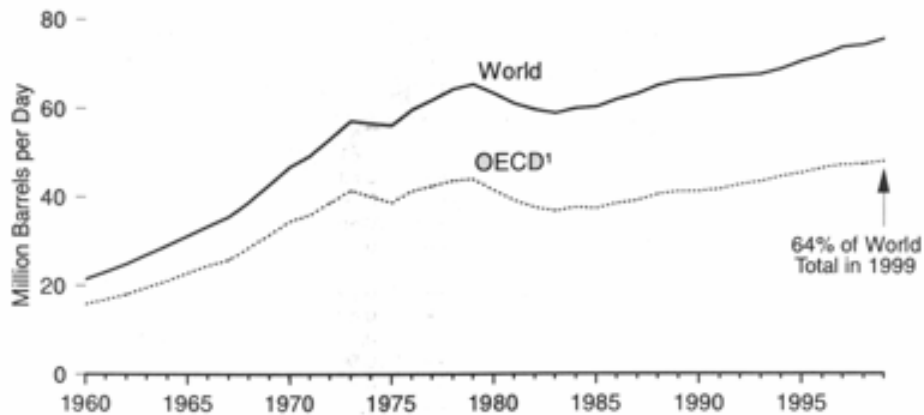
¹ Nominal dollars.

² Research Octane Number (RON) of 95.

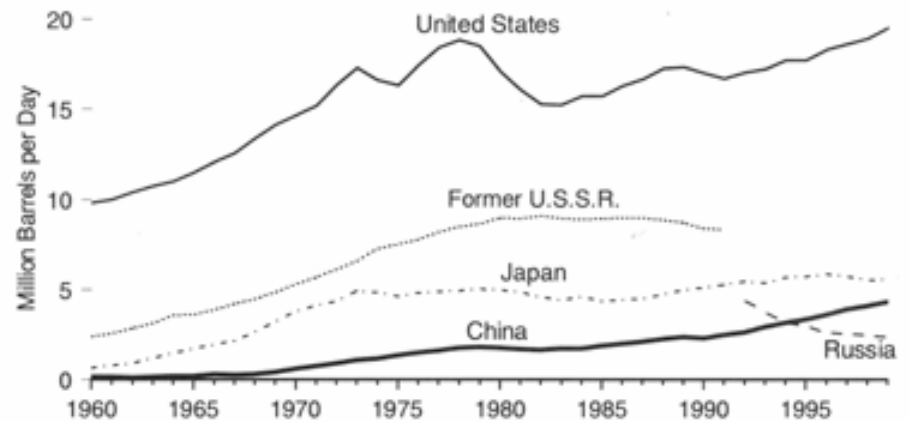
Source: Table 11.7.

WORLD PETROLEUM CONSUMPTION

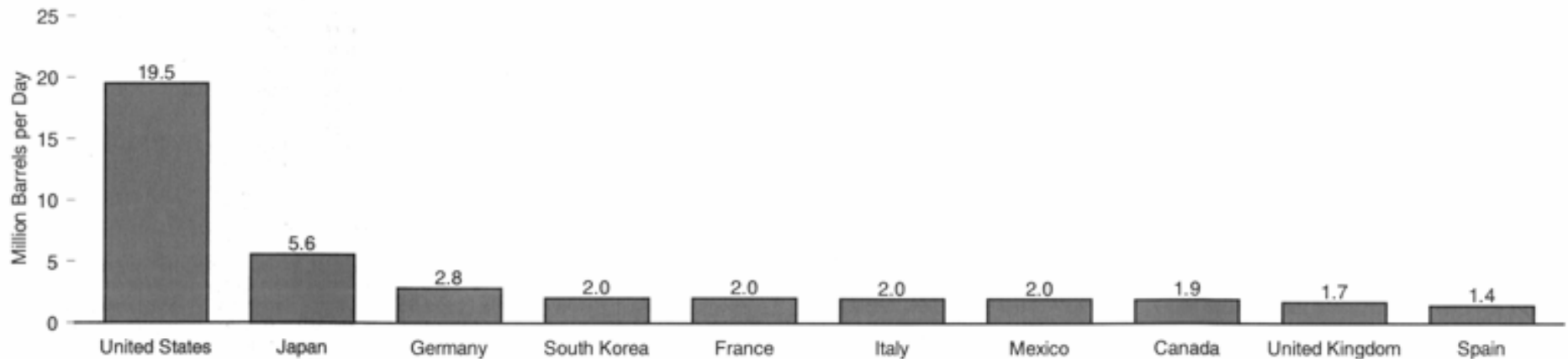
World and OECD,¹ 1960-1999



Leading Consumers, 1960-1999



Selected OECD¹ Consumers, 1999



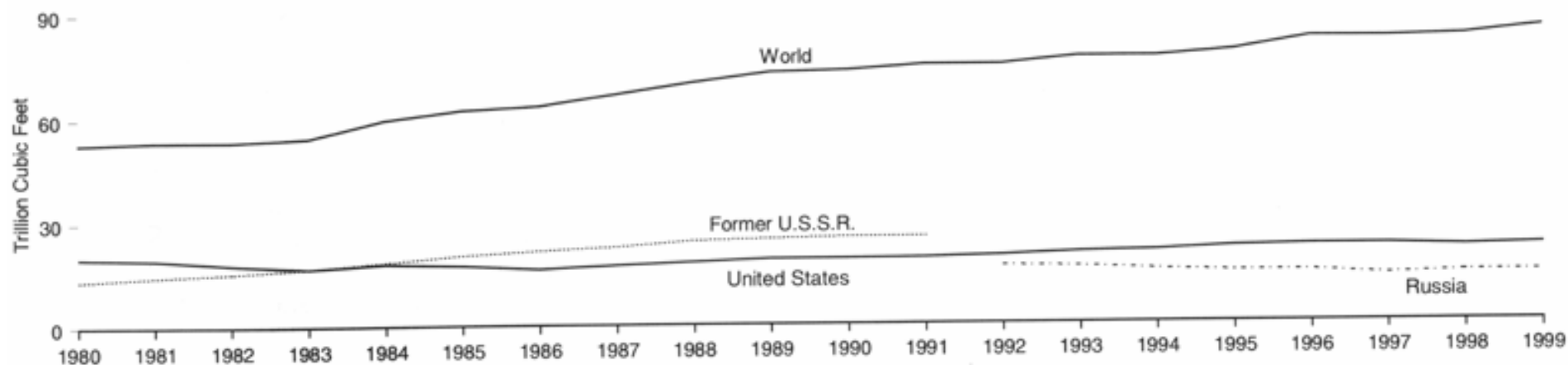
¹ Organization for Economic Cooperation and Development. See Glossary for membership.

Note: Because vertical scales differ, graphs should not be compared.

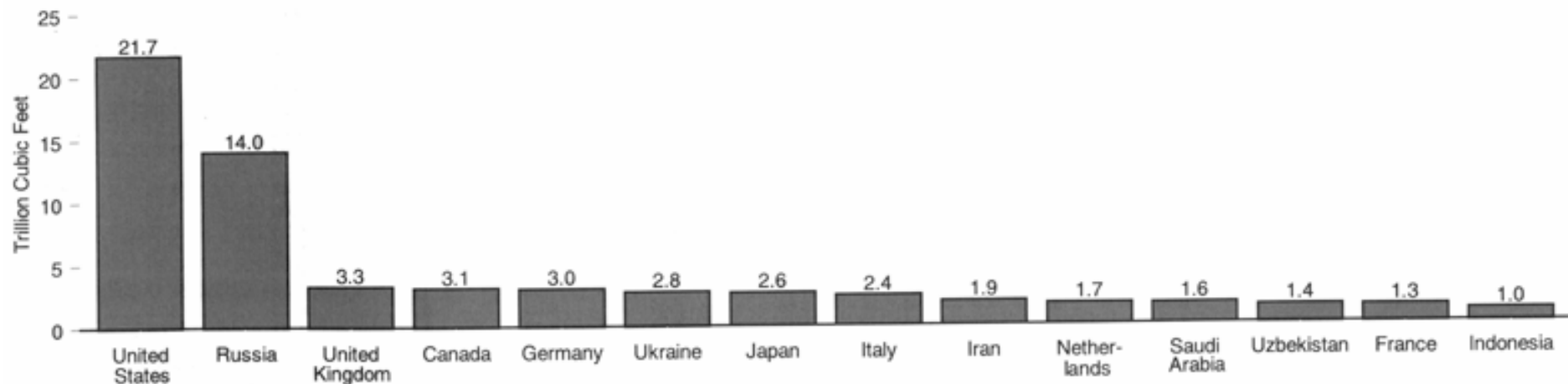
Source: Table 11.9.

WORLD DRY NATURAL GAS CONSUMPTION

World and Leading Consumers, 1980-1999



Selected Consuming Countries, 1999



Note: Because vertical scales differ, graphs should not be compared.

Source: Table 11.11.