



Collaborative Design & Development of Petroleum Sector Performance Indicators (PSI)

A research project of the National Commission on Energy Policy (NCEP)



(January 2007)

PSI Purpose & Objectives

- Find common language for policy debate
- Create capacity for fact-based discourse
- Integrate multiple and disparate data sources
- Reflect multiplicity of dimensions: supply, demand, efficiency, trade, prices, carbon emissions
- Find key measures of sector performance
- Provide perspective:
 - For U.S. and World
 - Reserves & production
 - GDP and economics
 - Structure of markets
- Track transportation sector performance: fuels & alternatives

PSI Drivers

- Undefined political terminology:
 - ‘energy independence’ ‘oil addiction’
- Inadequate measures of performance:
 - “reduce imports from volatile Middle-east”
- Highly complex market structure
 - Physical trade a fraction of total trade
- Dispersed and variably accessible data:
 - EIA, IEA, private industry
- Fragmented and non-comparable data:
 - On global fuel economy, alternative vehicles and fuels

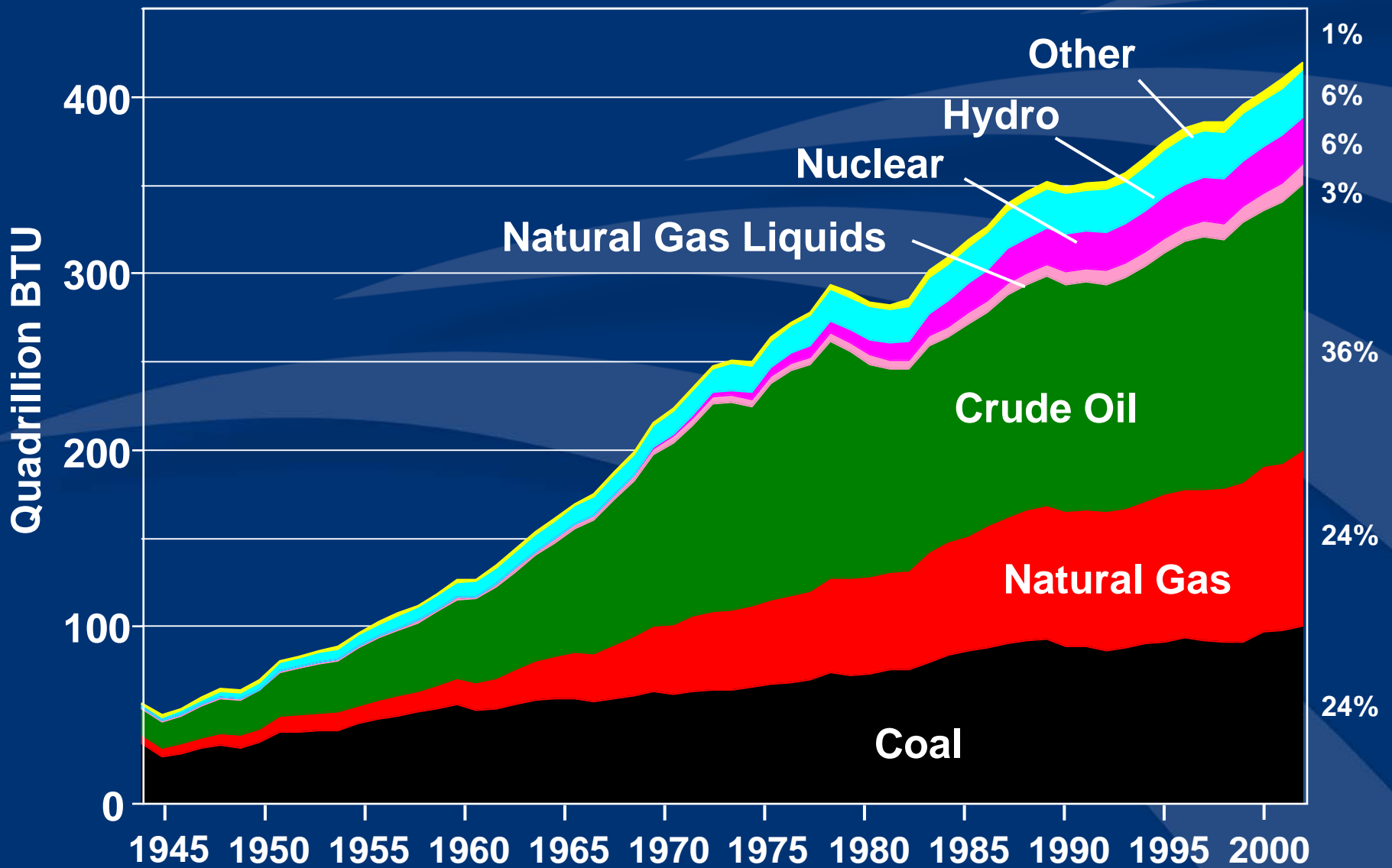
Roots of Energy Independence Policies

- “Let us unite in a major new endeavor that in this bicentennial era we can appropriately call ‘Project Independence.’” *Richard M. Nixon, 7 November 1973*
- “We must wage a simultaneous three-front campaign against recession, inflation and energy dependence.” *Gerald Ford, 13 January 1975*
- “Our decision about energy will test the character of the American people, and the ability of the President to govern this nation. This effort will be the moral equivalent of war.” *Jimmy Carter, 18 April 1977*

Supply

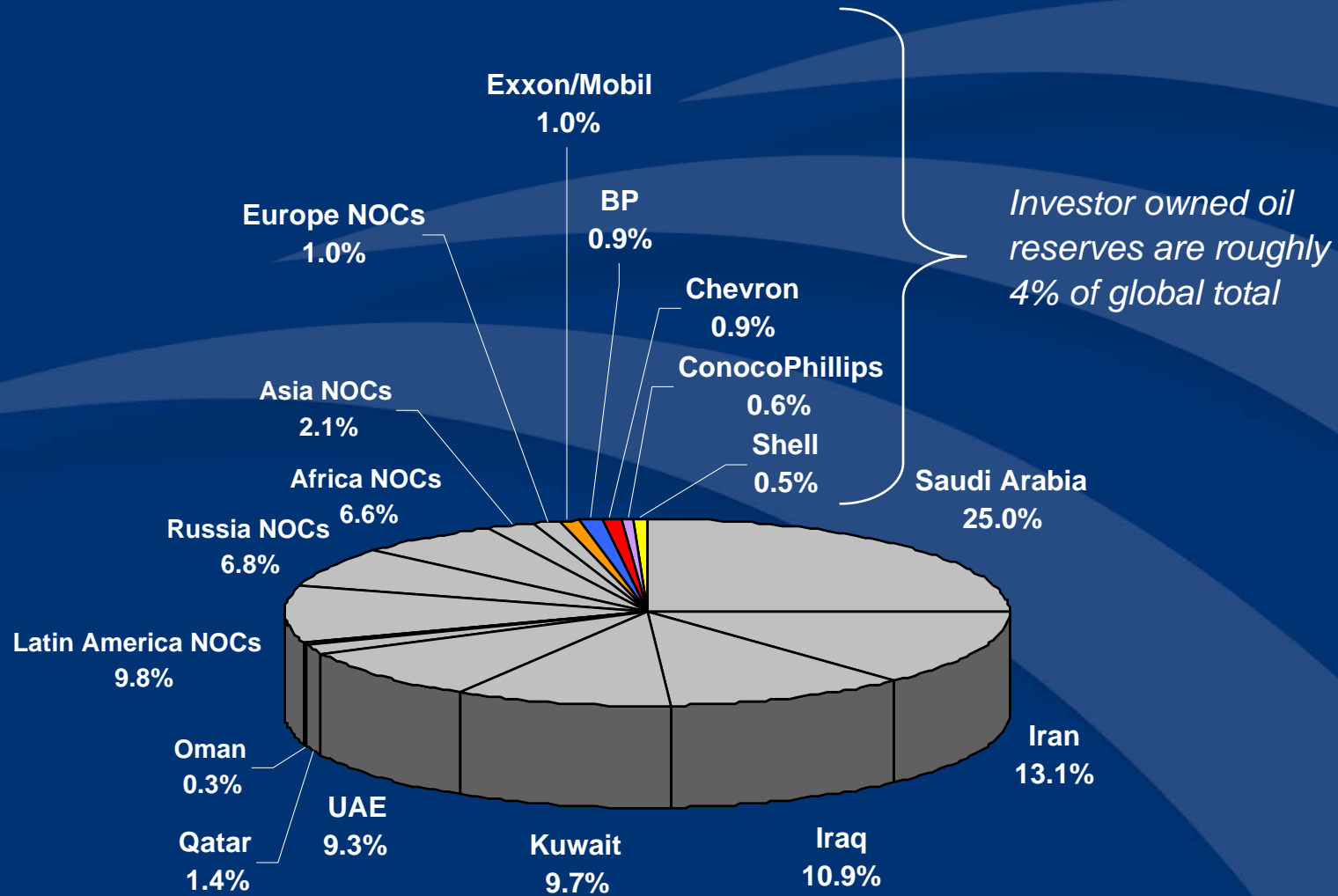
- Over 100 nations produce oil
- Over 80 nations export oil
- Estimates of NOC-controlled proved reserves range from 60% to 90%
- Surplus world production capacity in 2006 remains exclusive to Saudi Arabia

World Energy Production



Source: U.S. Geological Survey, 2003

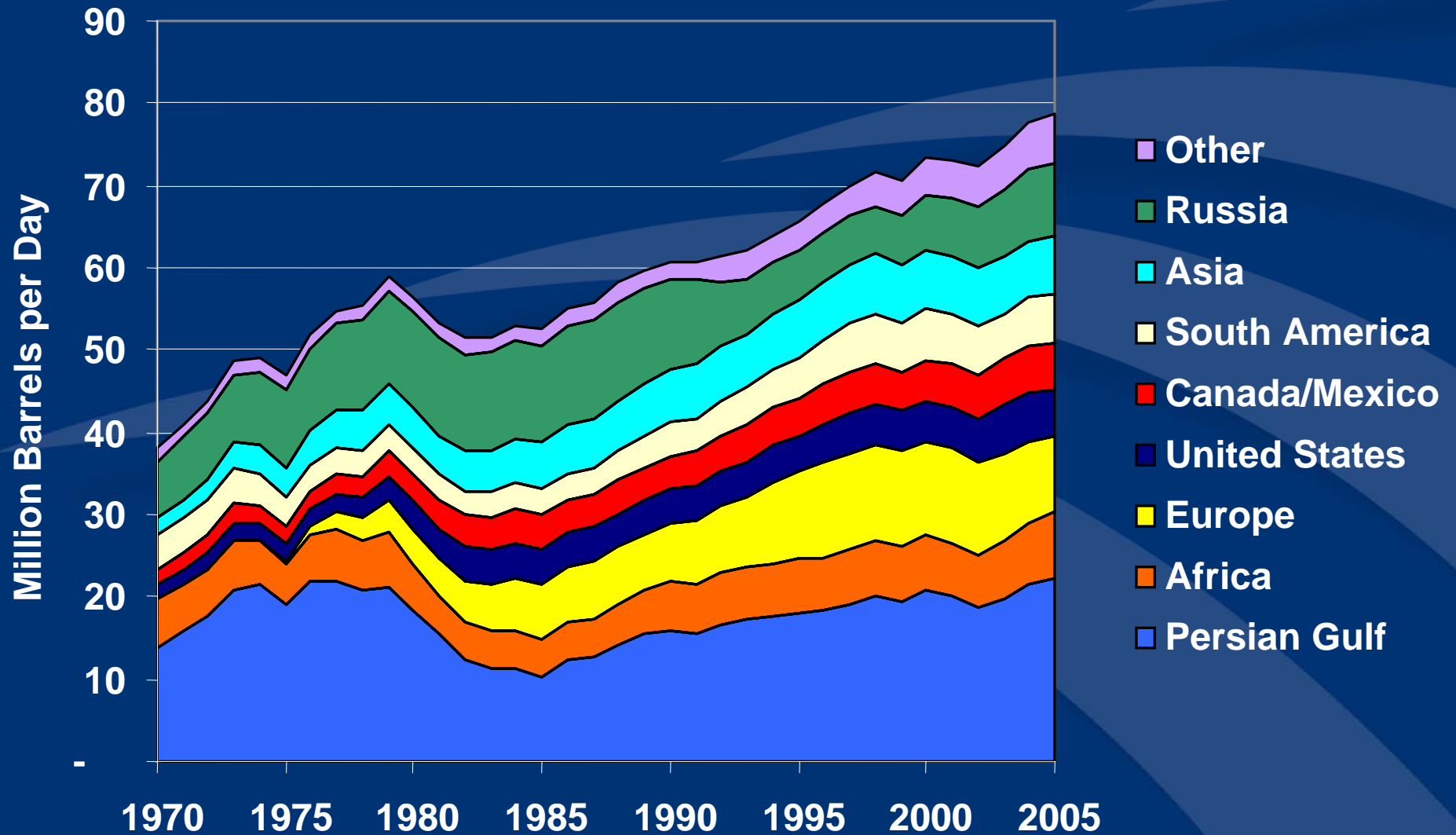
Global Proved Reserves (Top 30 = 1.2 Trillion Barrels)



Source: BP Statistical Review of World Energy, 2006.

<http://www.bp.com/productlanding.do?categoryId=6842&contentId=7021390>

World Crude Oil Production

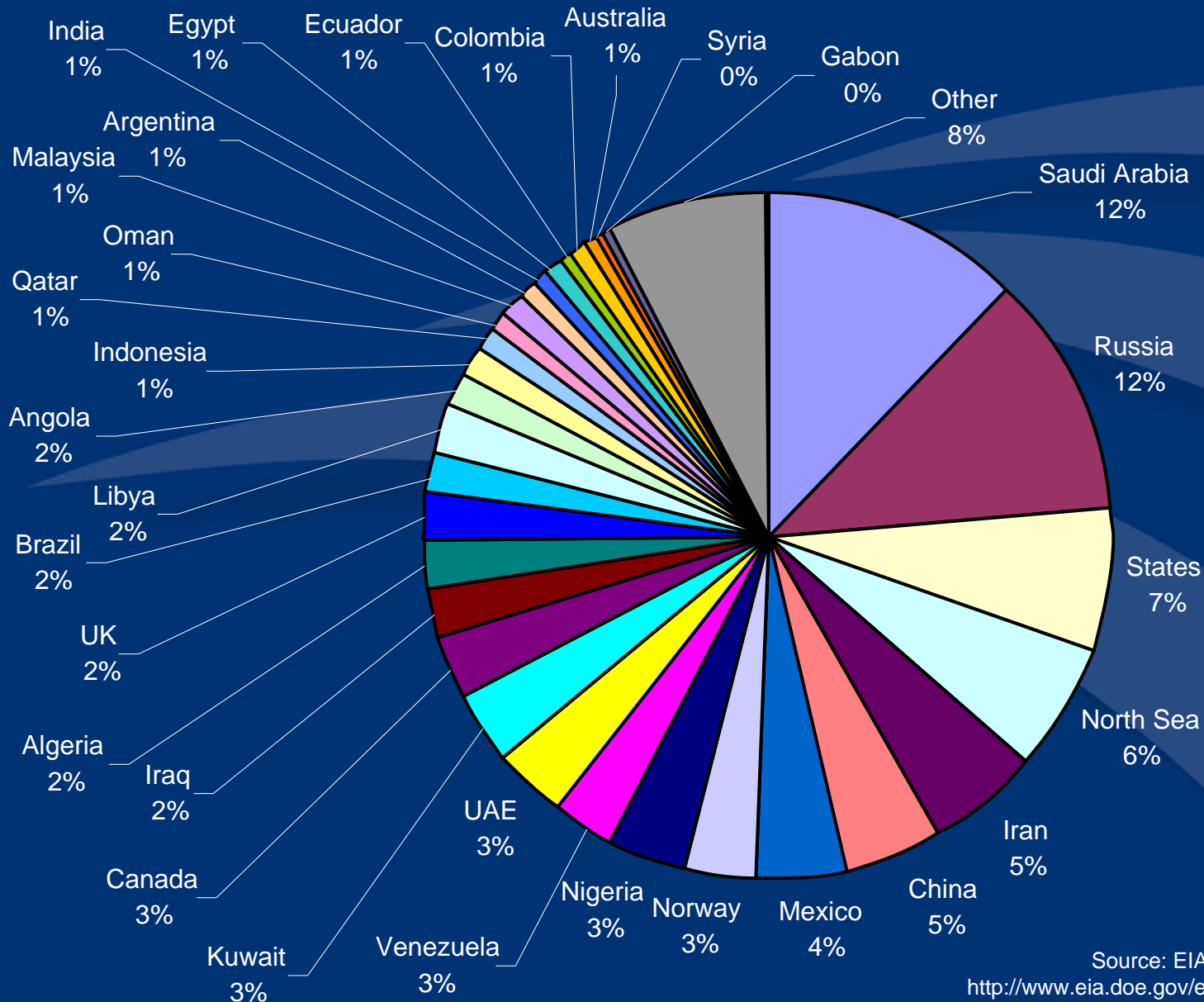


Note: Includes condensates.

Source: EIA International Petroleum Monthly, World Oil Production.
<http://www.eia.doe.gov/ipm/supply.html>

World Crude Oil Production

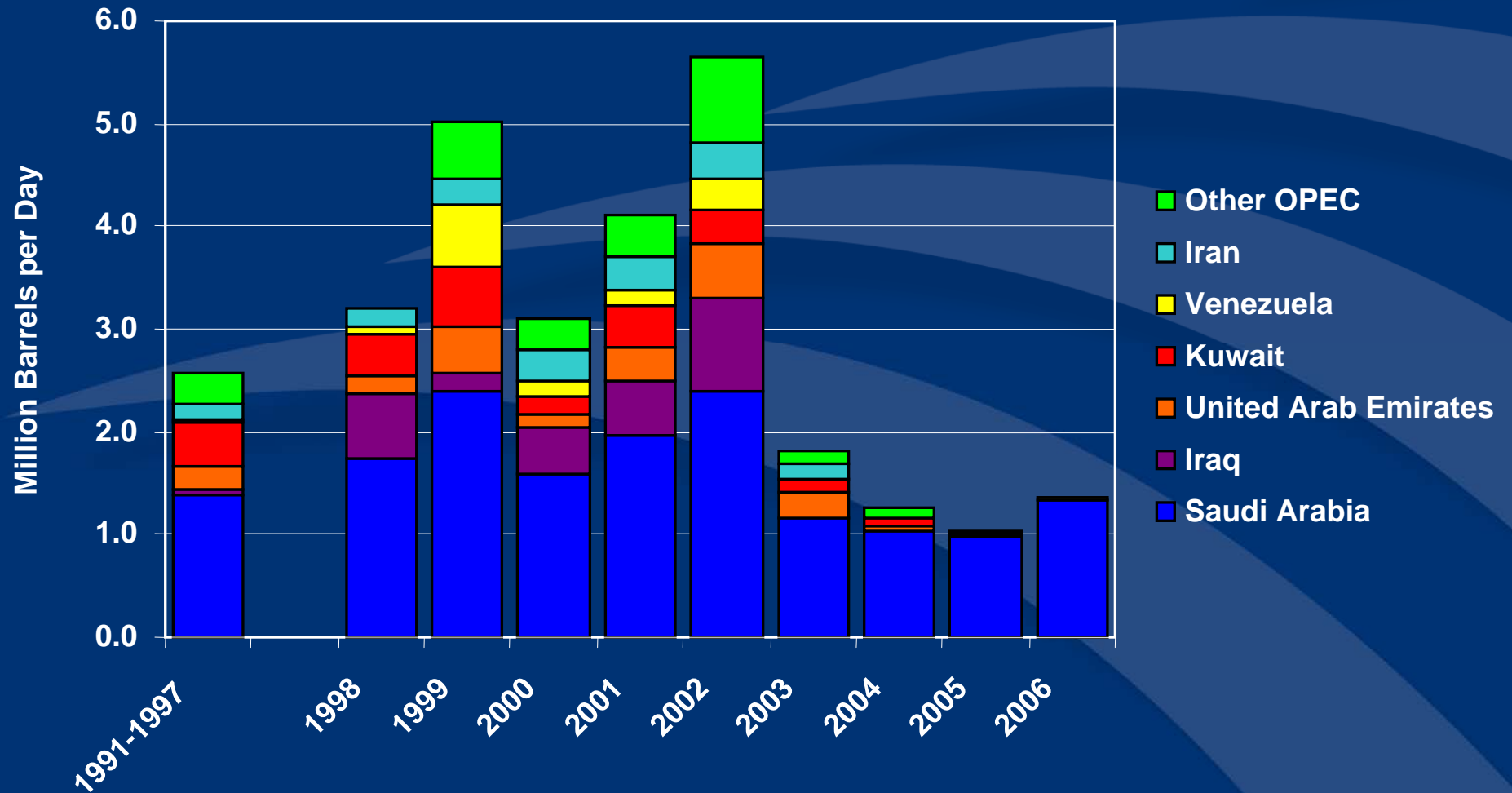
(2005 World Total=78.3 MMB/D)



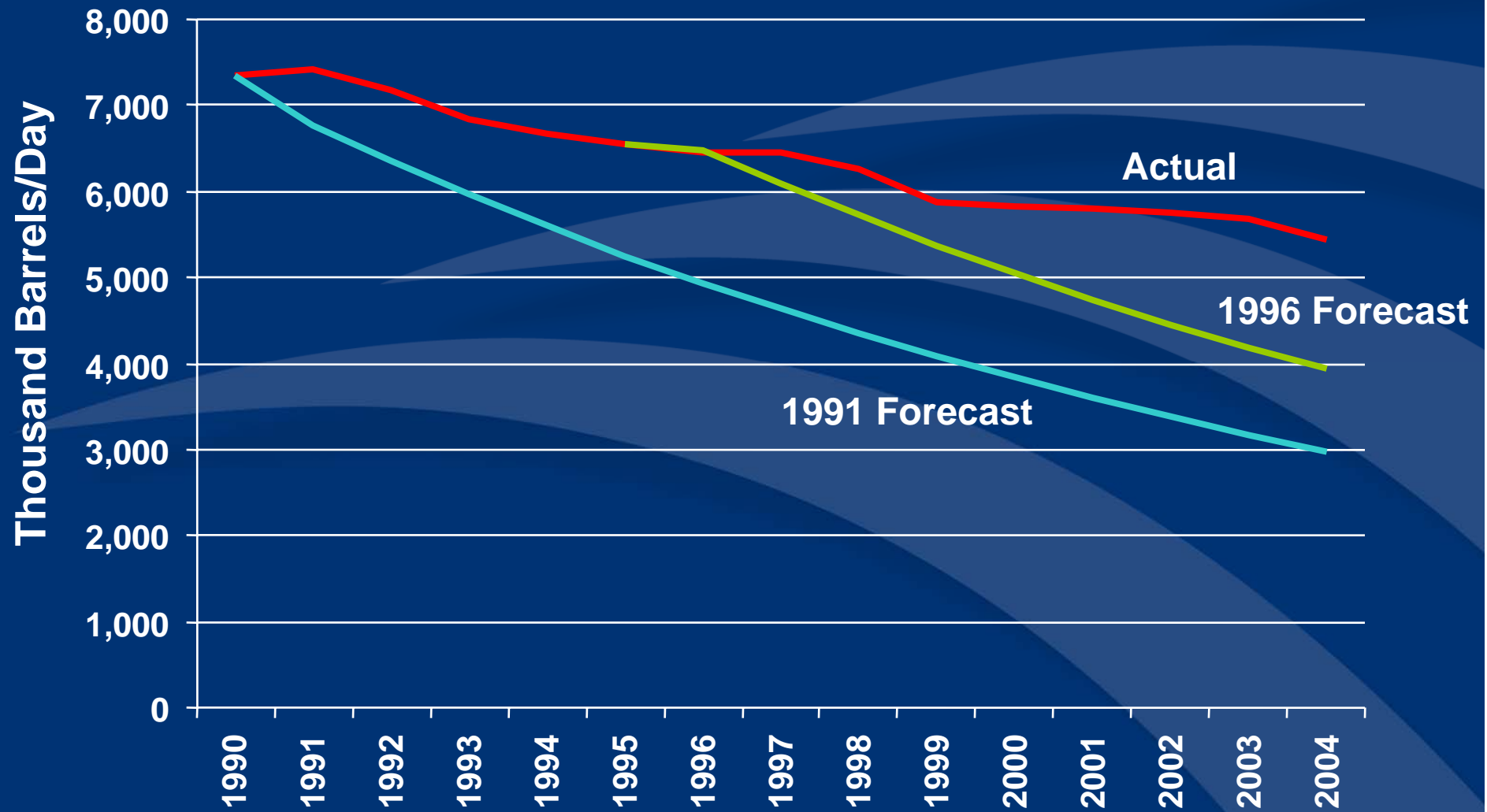
Note: Includes condensates.

Source: EIA International Energy Outlook, 2006
<http://www.eia.doe.gov/emeu/international/oilproduction.html>

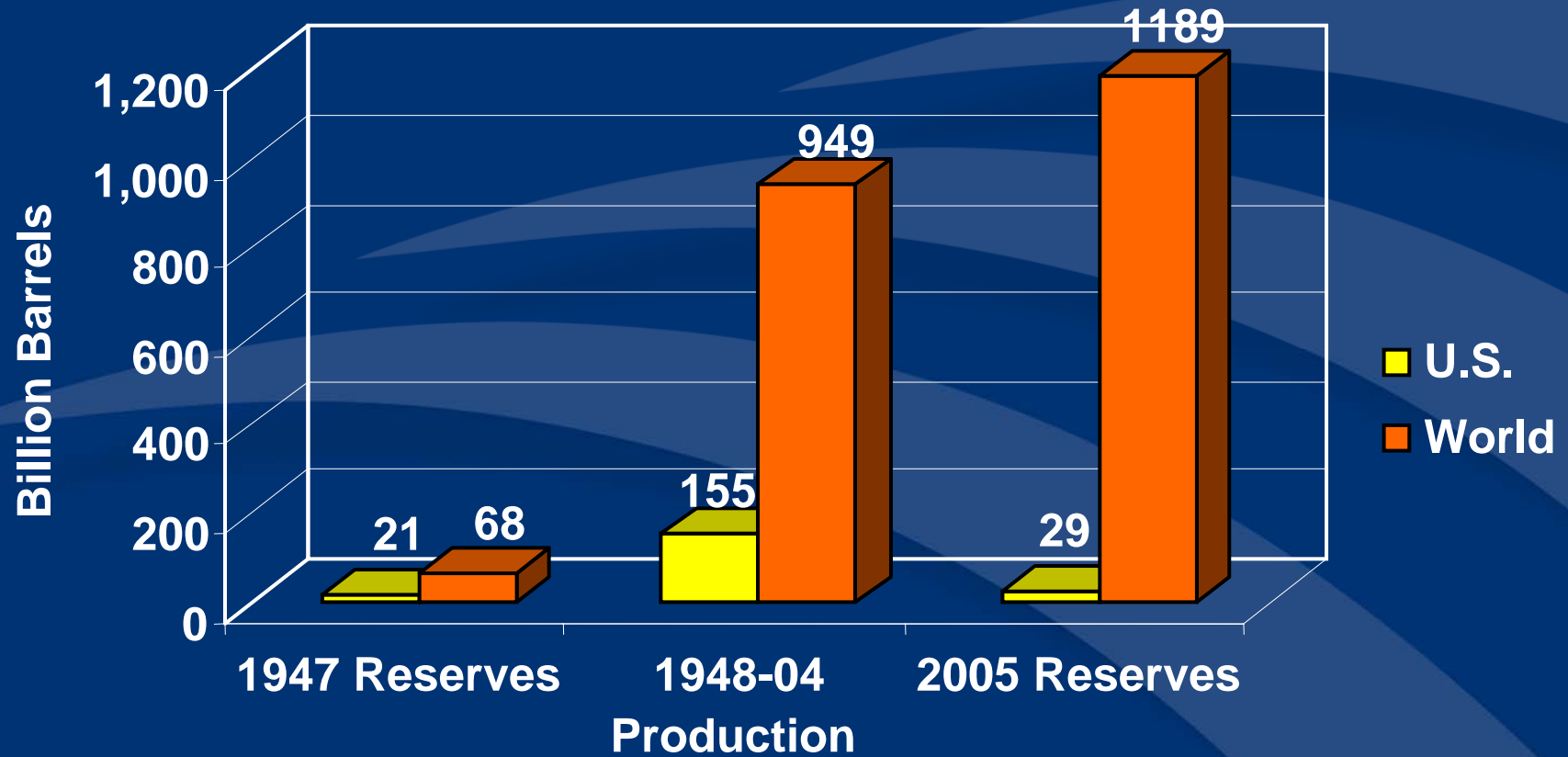
World Oil Surplus Production Capacity



U.S. Crude Oil Production and Campbell's Forecasts of Production

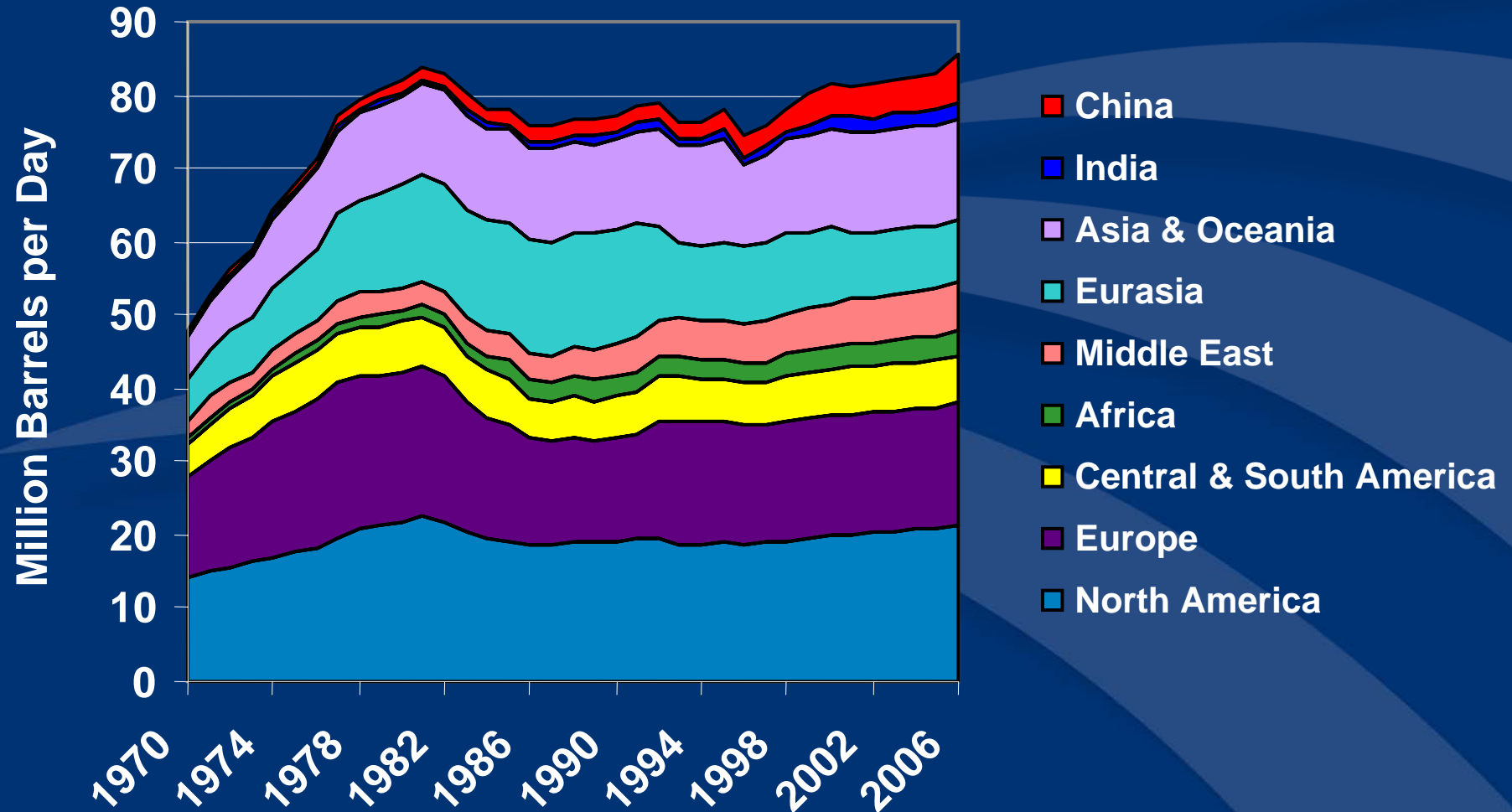


World Crude Oil Replenishment



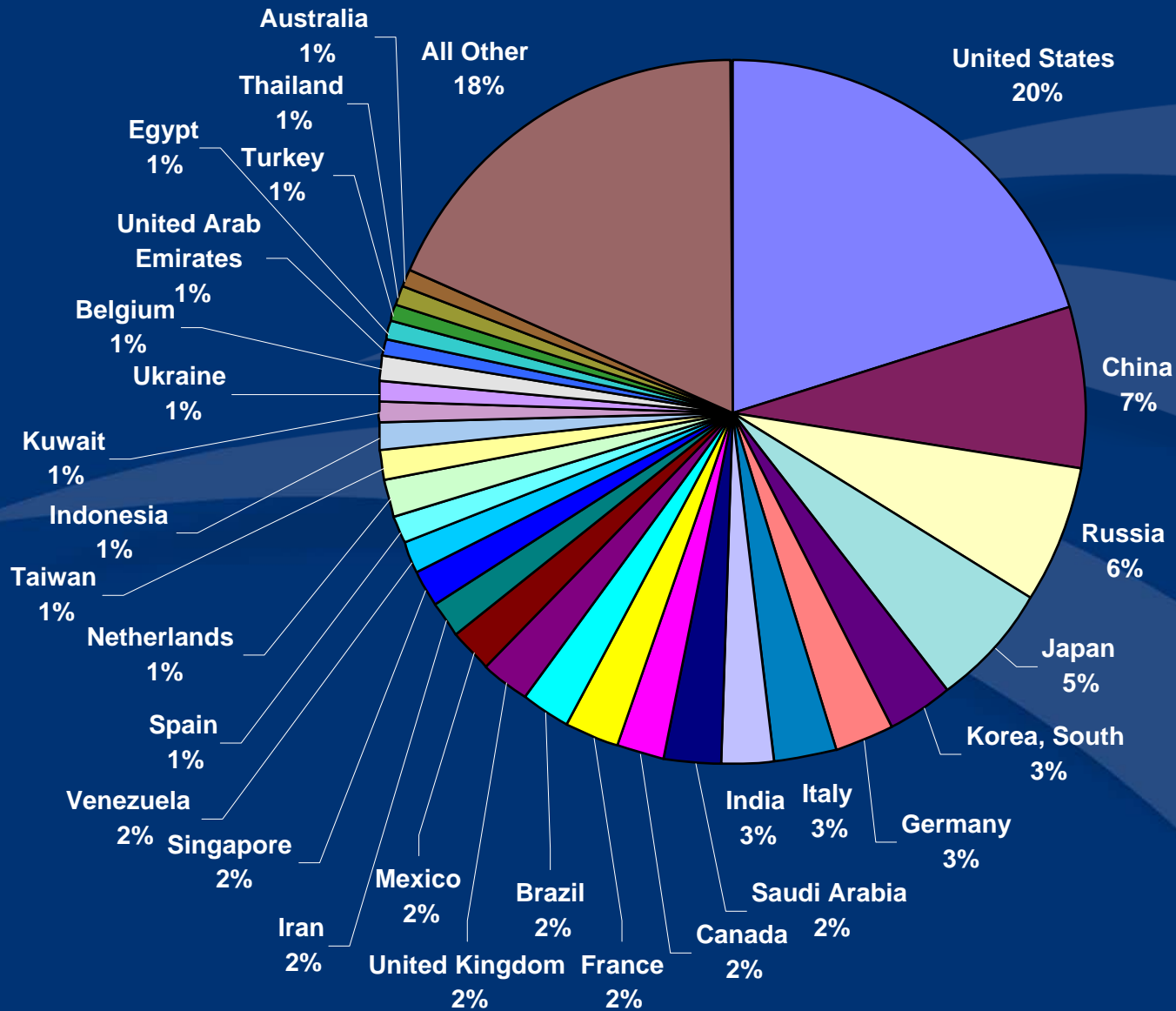
Source: EIA Petroleum Navigator, Crude Oil Production and Crude Oil Proved Reserves;
University of Texas-Austin, Center for Energy Economics.

World Crude Oil Distillation Capacity



Source: EIA International Energy Annual, World Petroleum Data.
<http://www.eia.doe.gov/pub/international/iea2004/table36.xls>

World Crude Oil Distillation Capacity (2006)

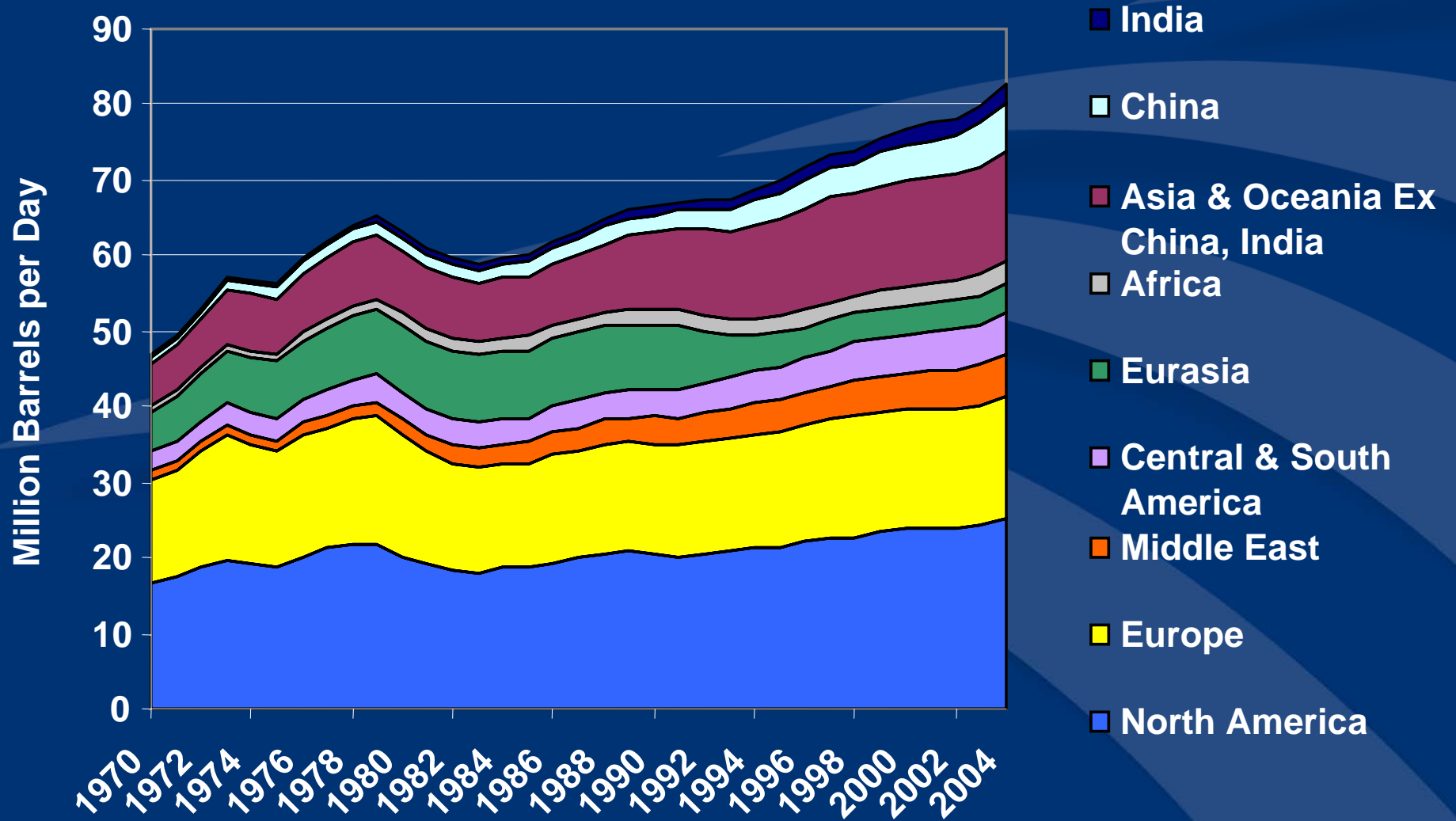


Source: EIA International Energy Annual, World Petroleum Data.
<http://www.eia.doe.gov/pub/international/iea2004/table36.xls>

Oil Consumption

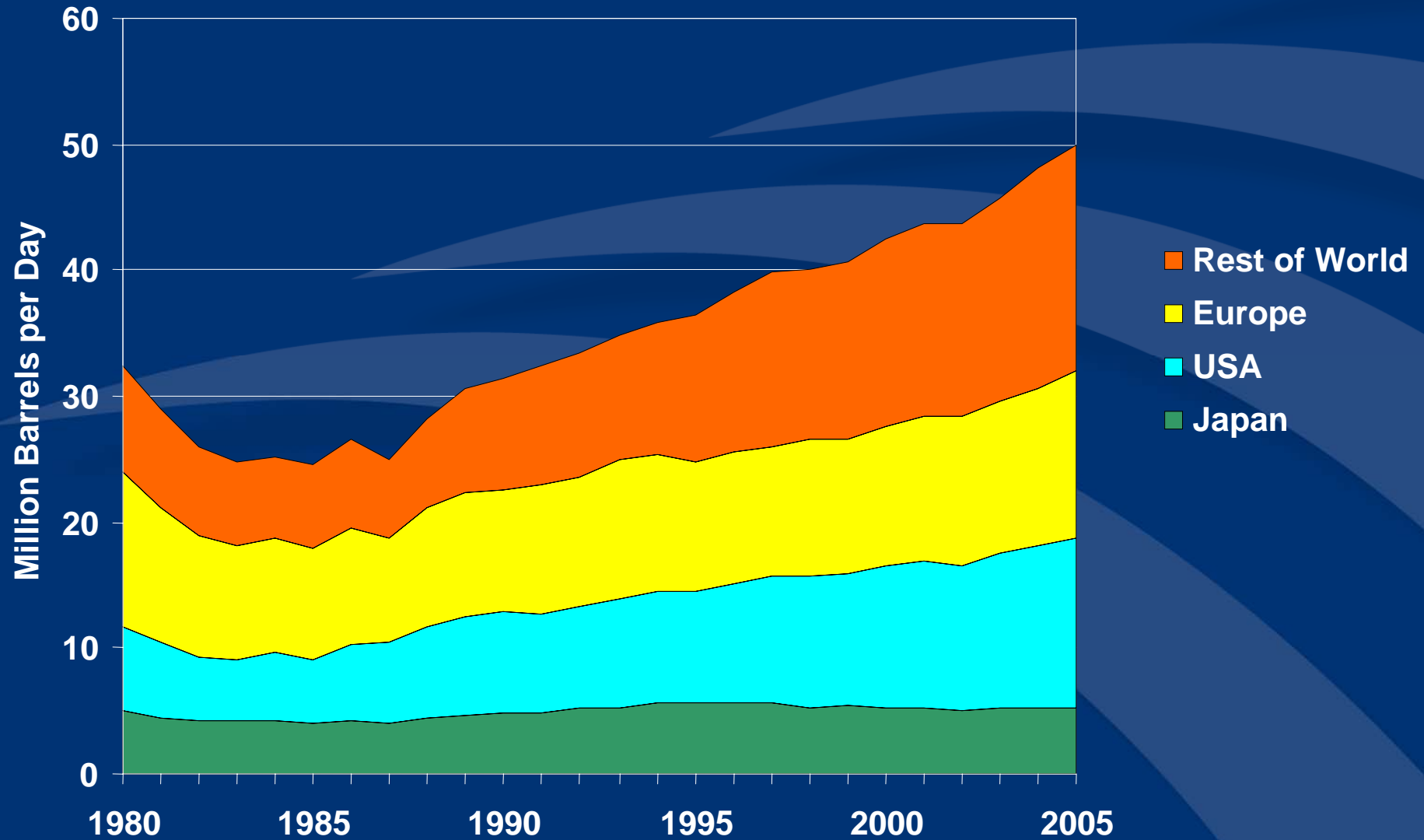
- World consumption: ~83 million barrels/day
- U.S. consumption: ~21 million barrels/day
- U.S. oil expenditures: ~\$800 billion/year
- U.S. oil expenditures: 3% of GDP
- Global trade in oil: ~50 million barrels/day
- Value of U.S. imports: ~\$250 billion/year
- U.S. oil imports: ~34% of trade imbalance

World Crude Oil Consumption



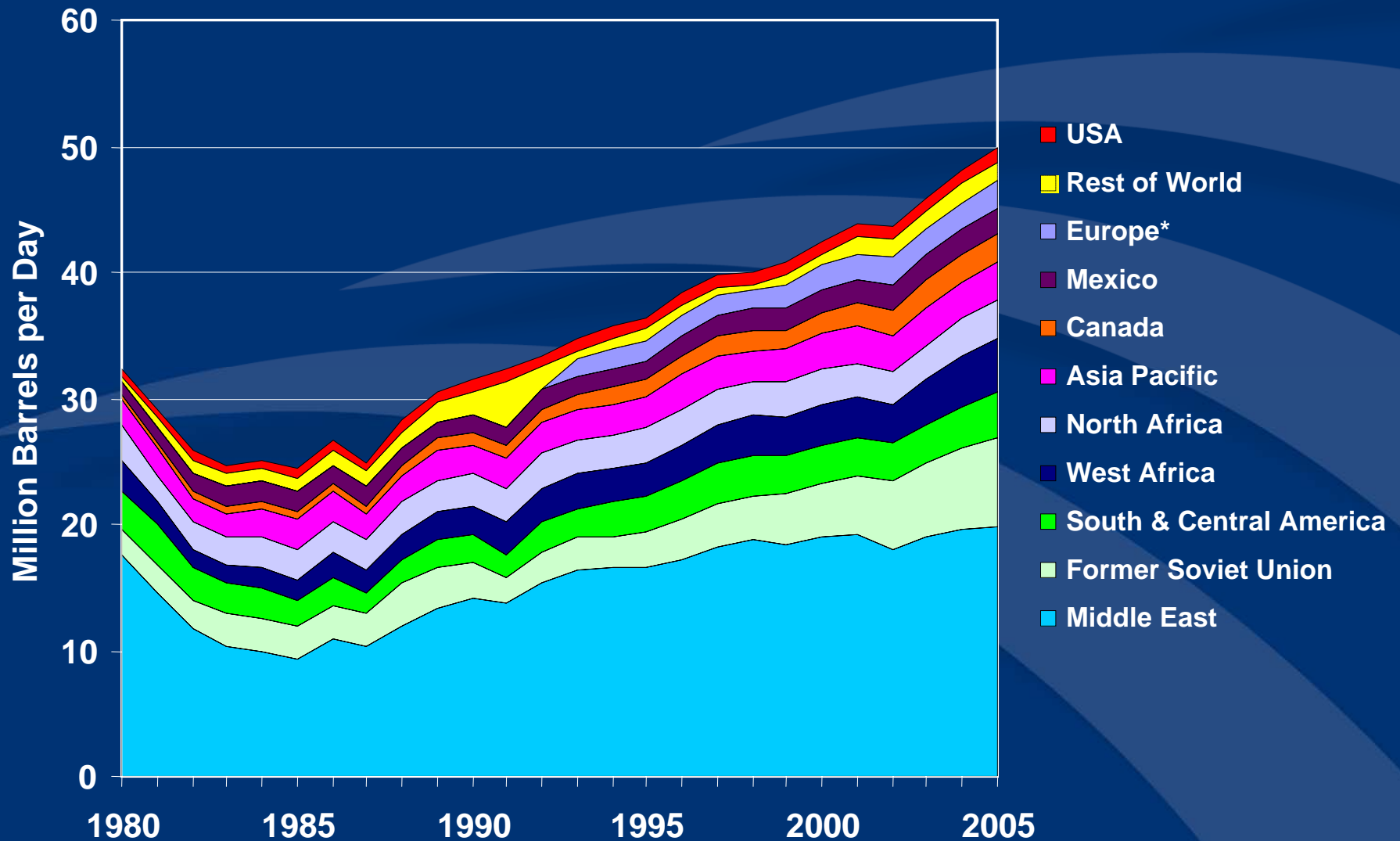
Sources: 1970-1979: Energy Information Administration, International Energy Database; 1980-2004: EIA International Petroleum Monthly <http://www.eia.doe.gov/pub/international/iealf/table12.xls>

Crude Oil Trade Movements (Imports)



Source: BP Statistical Review of World Energy, 2006.
<http://www.bp.com/productlanding.do?categoryId=6842&contentId=7021390>

Crude Oil Trade Movements (Exports)



* - European export data not available prior to 1993.

Source: BP Statistical Review of World Energy, 2006.
<http://www.bp.com/productlanding.do?categoryId=6842&contentId=7021390>

Petroleum Imports

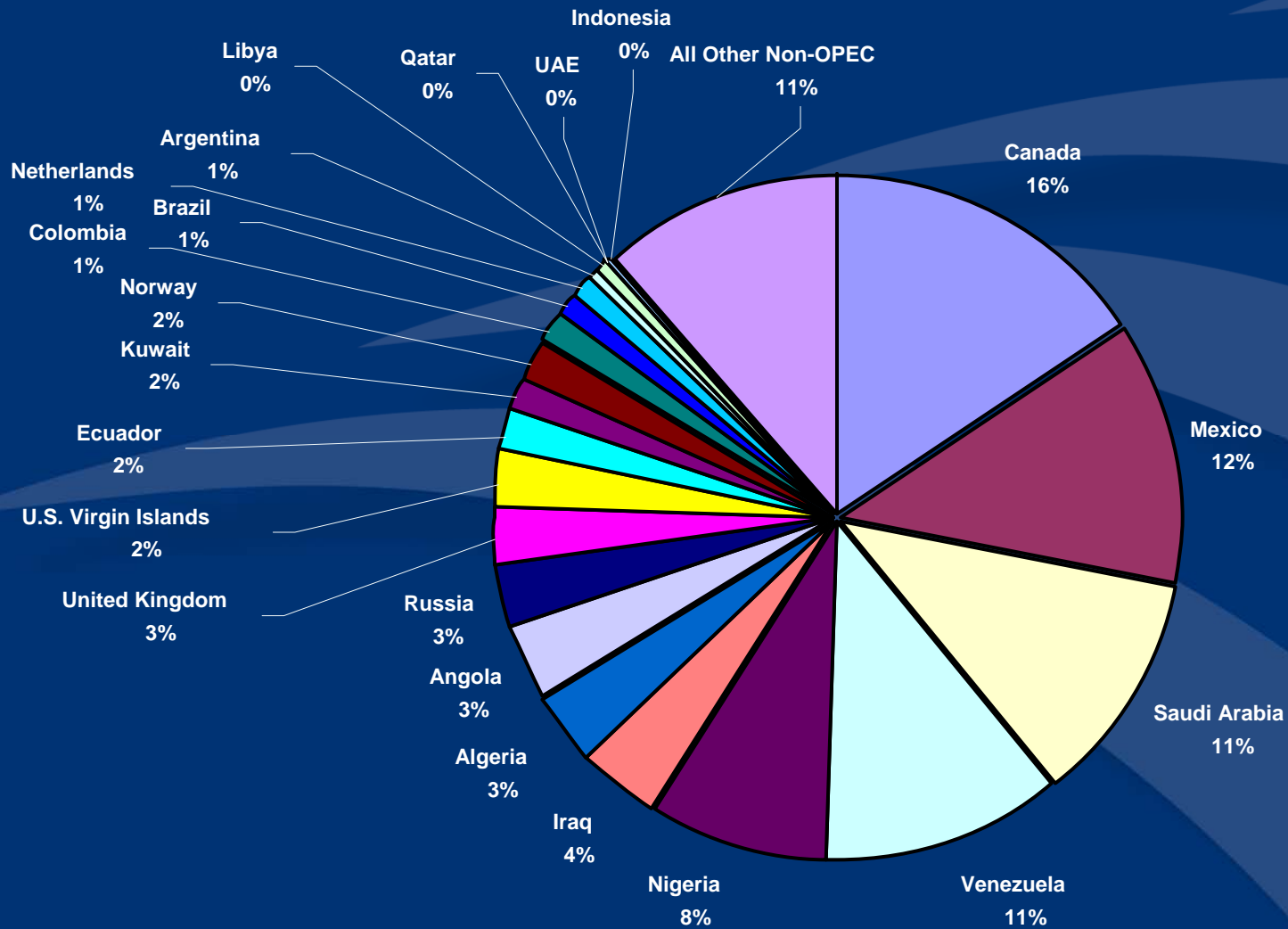
- U.S. imports: 13.7 million barrels/day
- U.S. imports rose by 2.2 million barrels/day between 2002 and 2005
- In same period, Chinese imports rose by 1.8 million barrels/day, and
- Indian imports rose by 0.45 million barrels/day

U.S. Dependence on Oil Imports

(As Percentage of Total Oil Consumption)

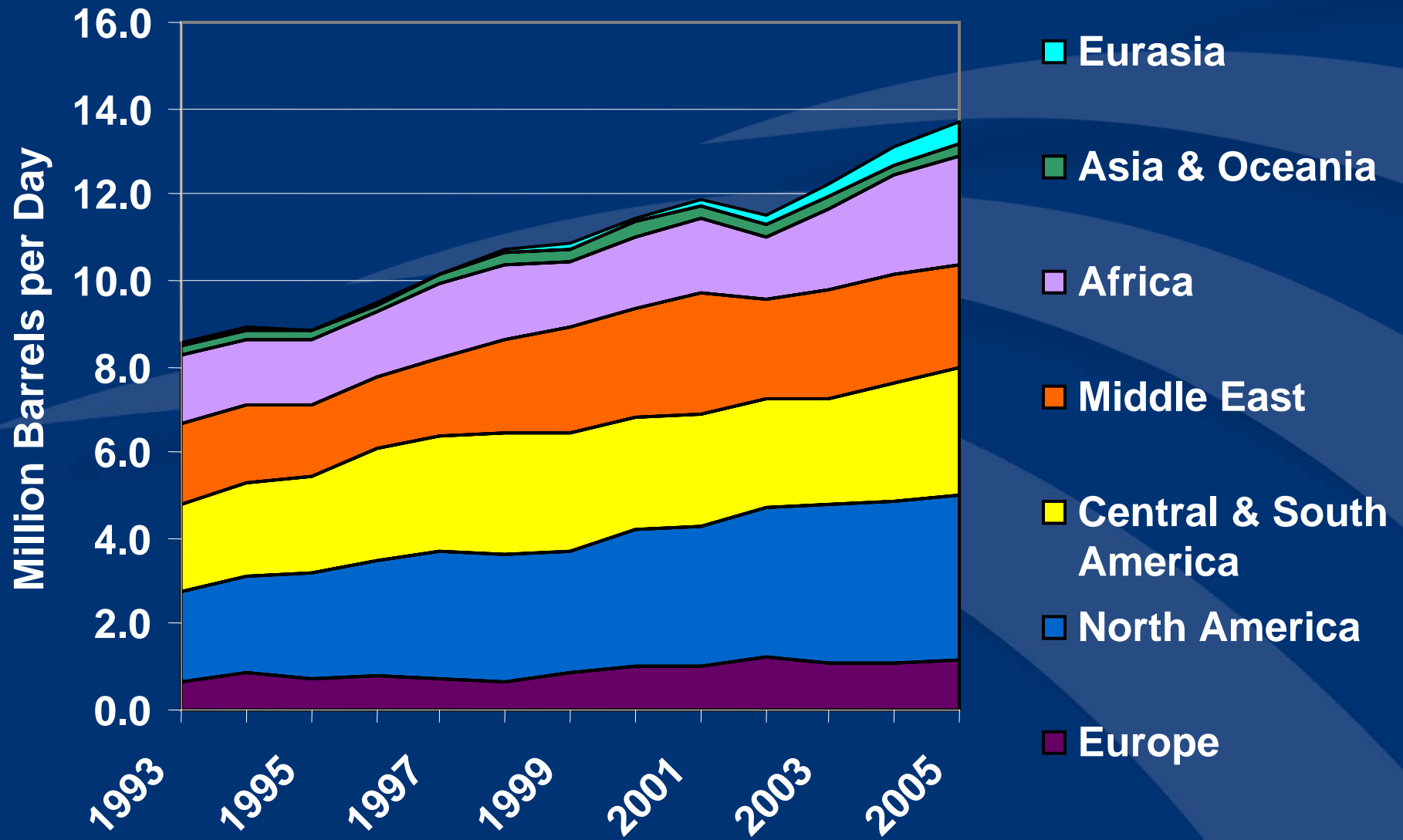
Nixon Administration (1974)	37%
Ford Administration (1976)	42%
Carter Administration (1980)	41%
Reagan Administration (1988)	43%
Bush Administration (1992)	46%
Clinton Administration (2000)	58%
Bush Administration (2005)	66%

U.S. Oil Imports by Source (2005)



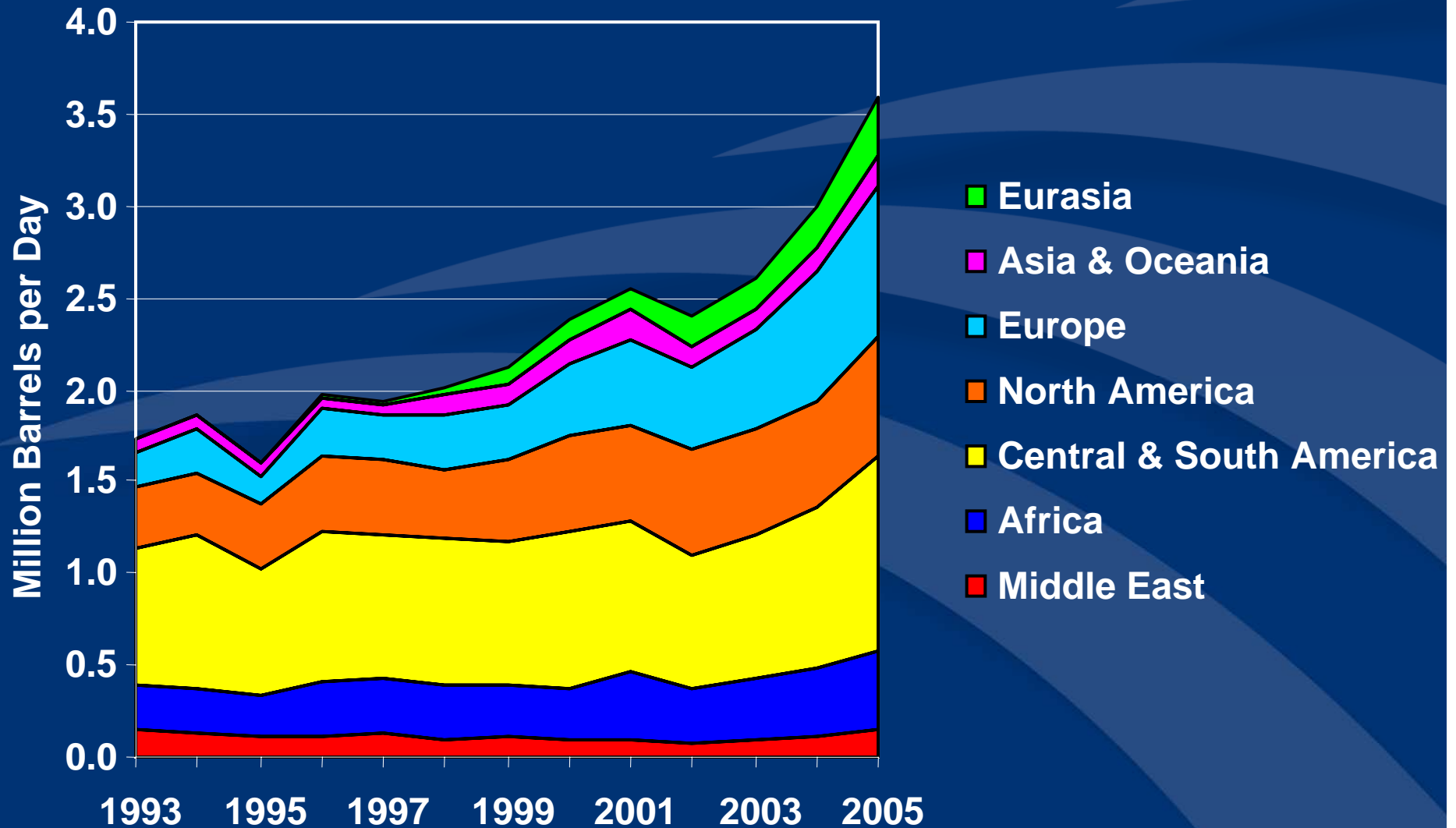
Source: U.S. Imports by Country of Origin, EIA Petroleum Navigator

U.S. Oil Imports by Source



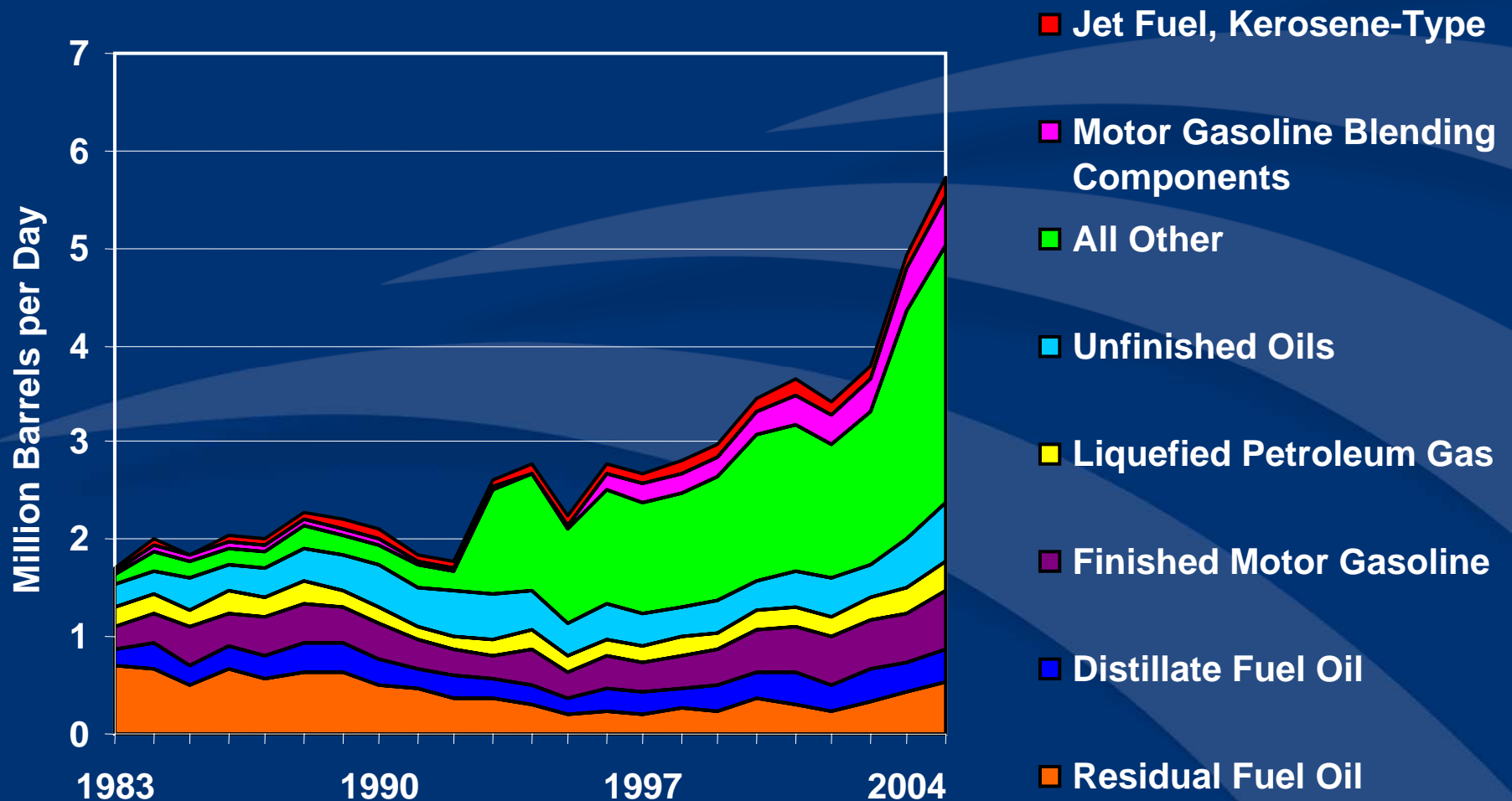
Source: EIA Petroleum Navigator, U.S. Imports by Country of Origin, http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbldpd_a.htm

U.S. Petroleum Product Imports by Source



Source: EIA Petroleum Navigator, U.S. Petroleum Products Imports by Country of Origin, http://tonto.eia.doe.gov/dnav/pet/xls/pet_move_impcus_a2_nus_EPP0_im0_mbbldpd_a.xls

U.S. Imports of Petroleum Products by Type

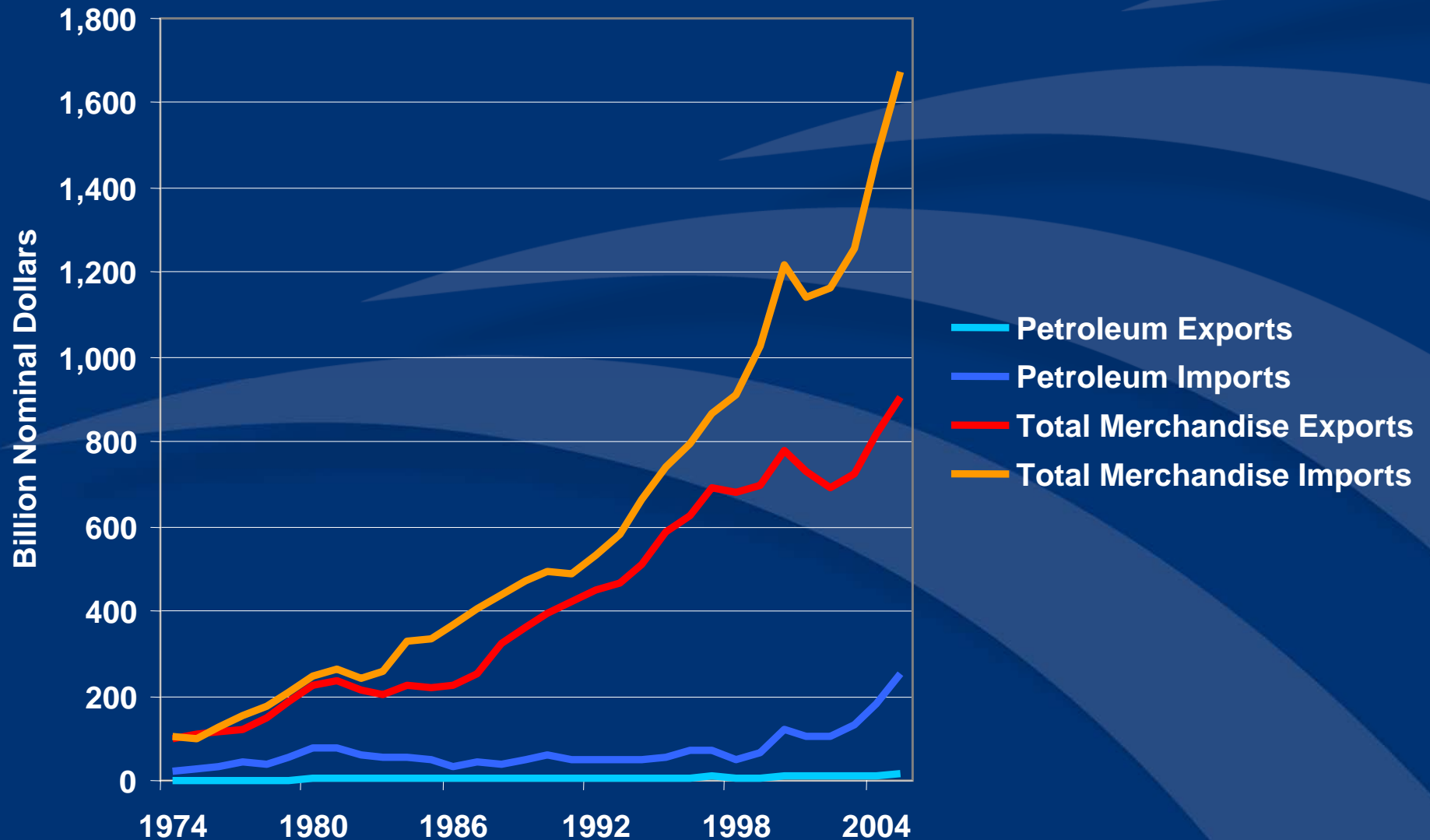


Source: EIA Petroleum Navigator, U.S. Petroleum Products Imports,
http://tonto.eia.doe.gov/dnav/pet/xls/pet_move_impcus_d_nus_Z00_mbbldpd_a.xls

Petroleum Trade Values

- Global Trade in oil: ~50 million barrels/day
- Value of global trade: ~\$1 trillion/year
- Value of U.S. oil trade: \$250 billion
- Oil share of U.S. trade imbalance: 34%

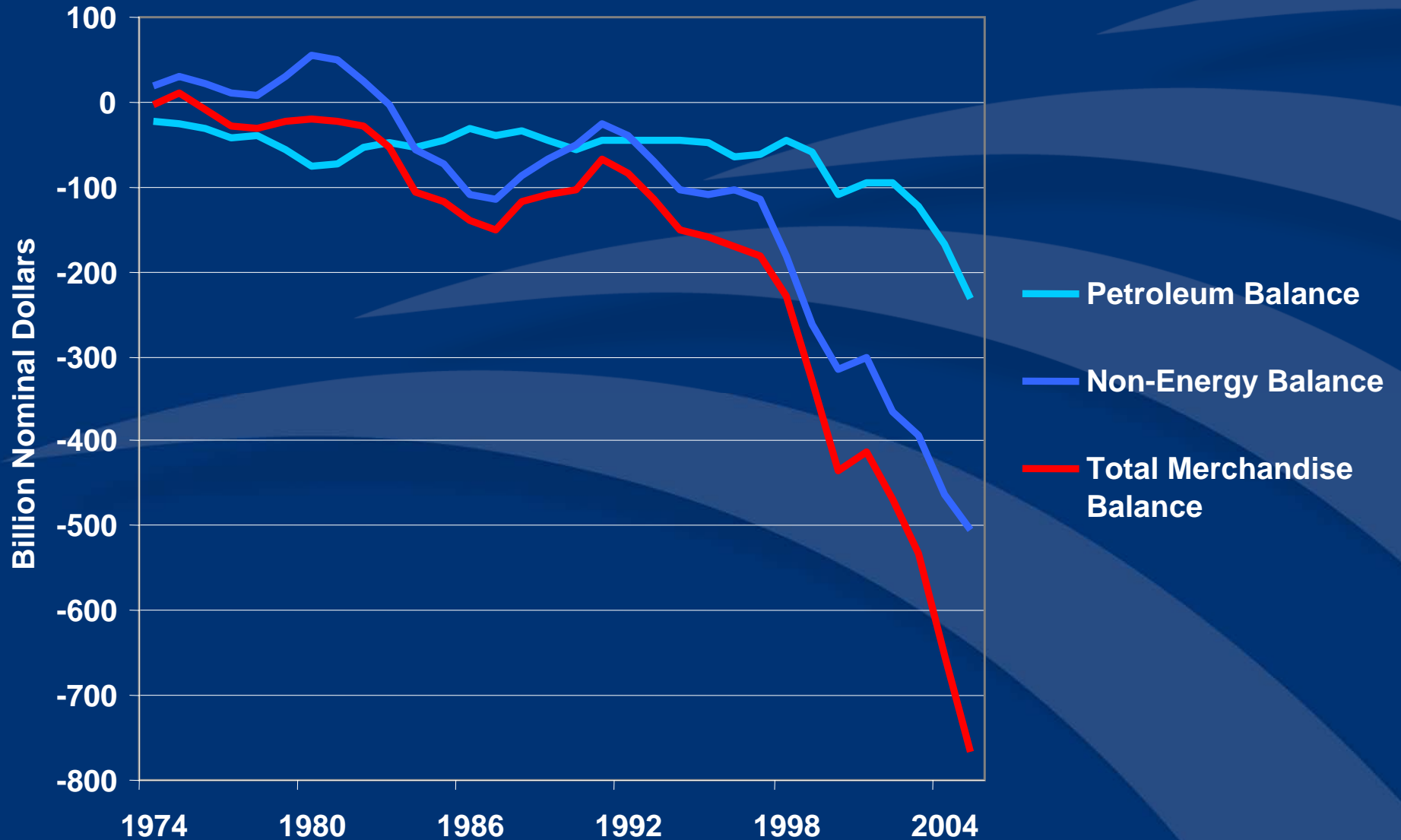
U.S. Import and Export Trade Values



Note: Petroleum includes crude oil, petroleum preparations, liquefied propane and butane, and other mineral fuels.

Source: EIA Monthly Energy Review, Merchandise Trade Value.
<http://www.eia.doe.gov/emeu/mer/overview.html>

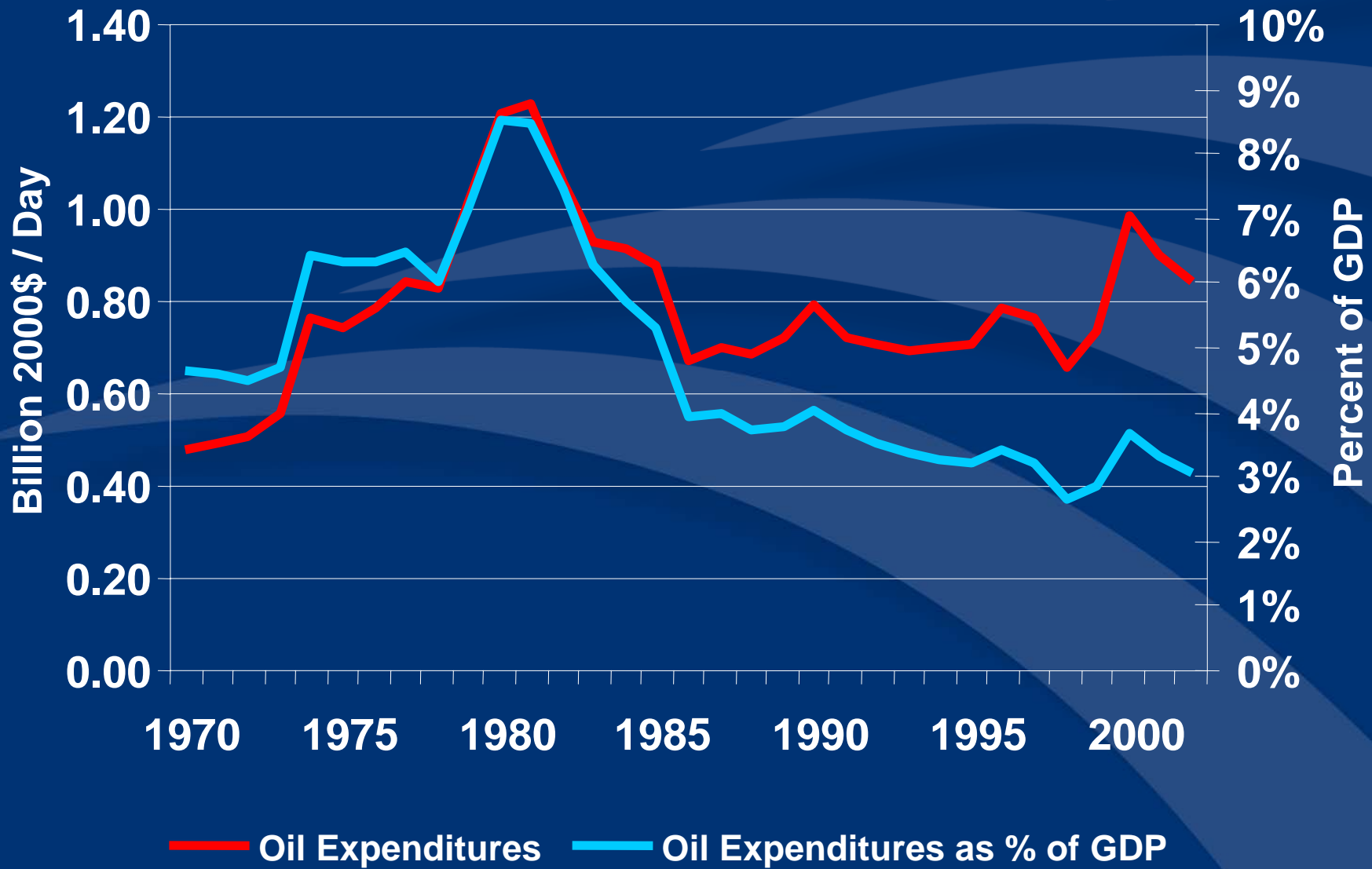
U.S. Trade Balances



Note: Petroleum includes crude oil, petroleum preparations, liquefied propane and butane, and other mineral fuels.

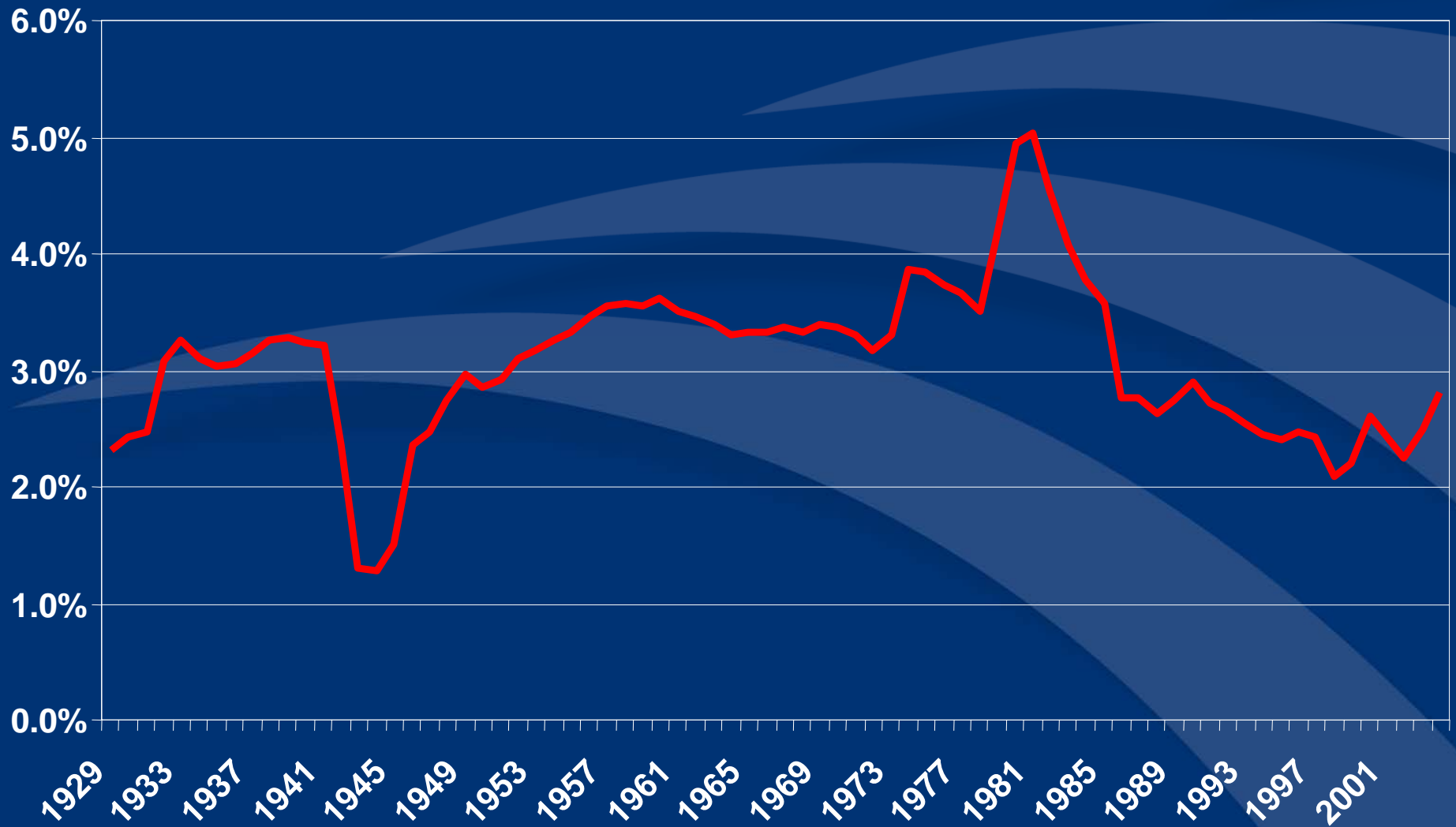
Source: EIA Monthly Energy Review, Merchandise Trade Value.
<http://www.eia.doe.gov/emeu/mer/overview.html>

U.S. Oil Expenditures



Source: EIA Annual Energy Review 2005

Gasoline Share of Total U.S. Consumption Expenditures

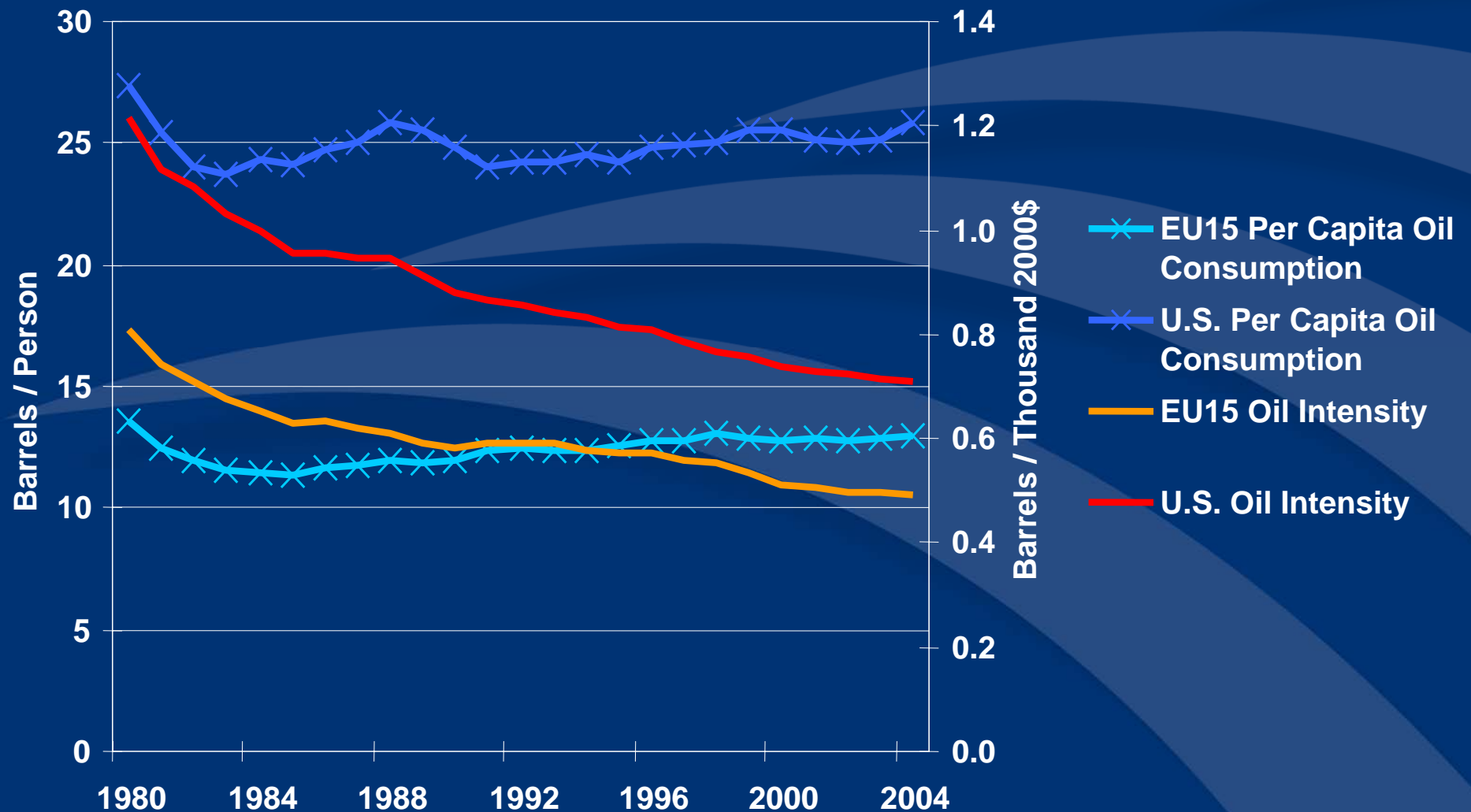


Source: NIPA

Intensity of Oil Consumption

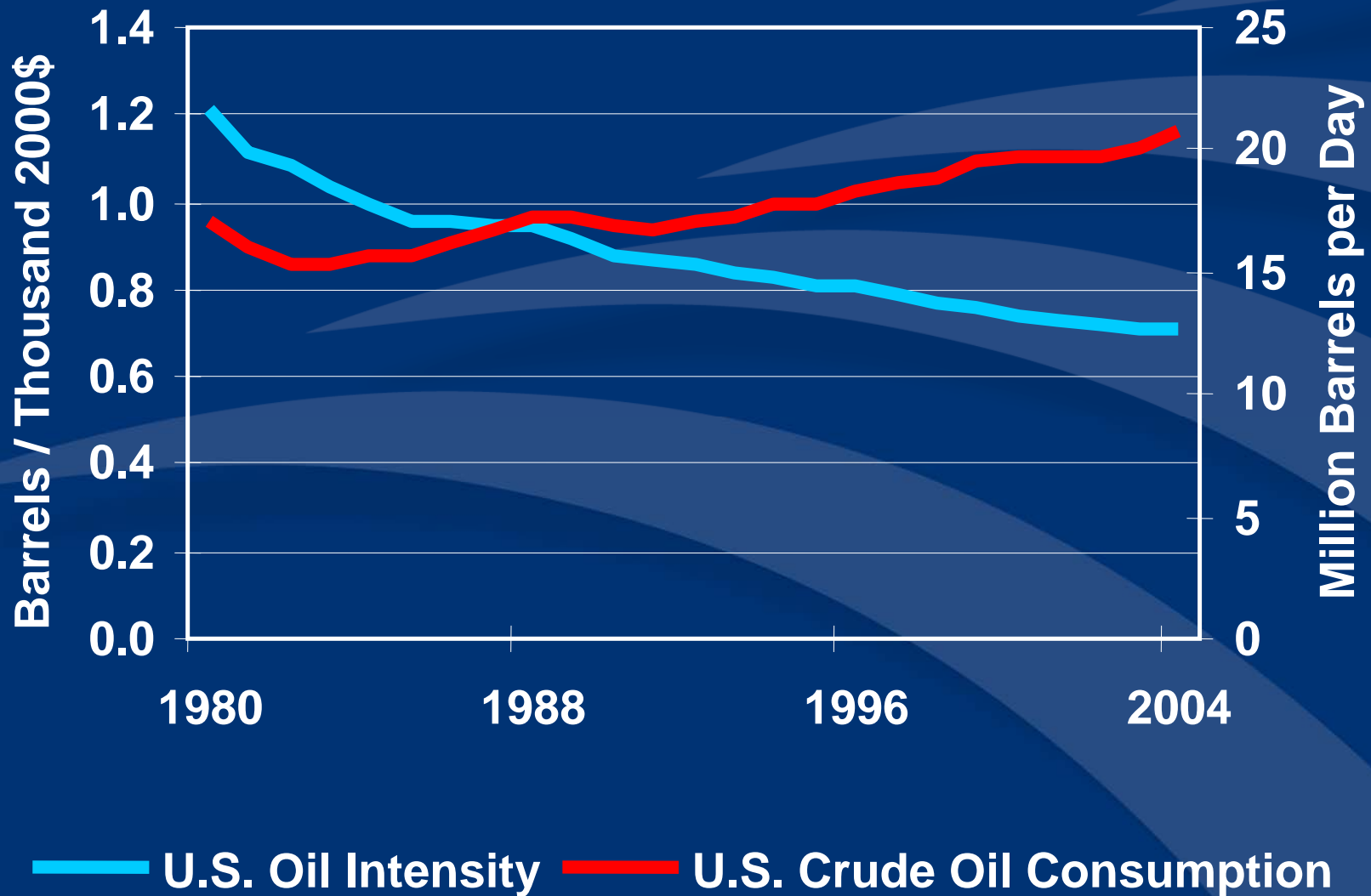
- U.S. oil consumption per unit of GDP declined by 42% between 1980 and 2004
- EU-15 oil consumption/GDP declined by 39% in the same period
- U.S. per capita oil consumption decreased by 5.5% between 1980 and 2004
- EU-15 per capital oil consumption decreased by 4.2% in the same period
- Total U.S. oil consumption increased by 22% between 1980 and 2004

U.S. and EU-15 Oil Consumption per unit GDP and per Capita



Sources: EIA International Energy Annual 2004, <http://www.eia.doe.gov/pub/international/iealf/table12.xls>; U.S. Department of Commerce, Bureau of the Census, Population Division, International Programs Center, International Data Base, April 26, 2005; International Energy Agency, Energy Balances of OECD Countries, 2006 Edition.

U.S. Oil Consumption and Oil Intensity per unit GDP

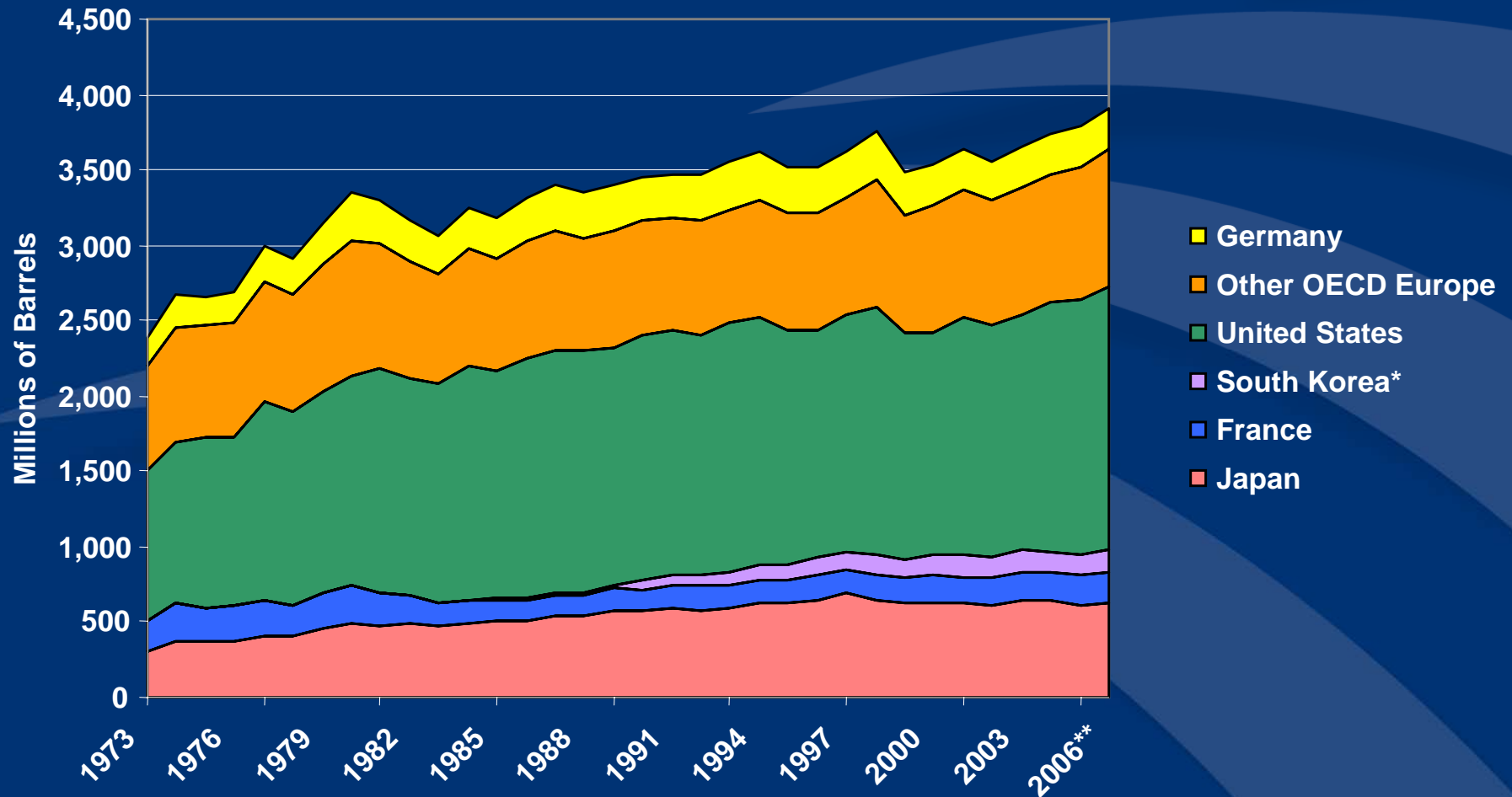


Sources: EIA International Energy Annual 2004, <http://www.eia.doe.gov/pub/international/iealf/table12.xls>; U.S. Department of Commerce, Bureau of the Census, Population Division, International Programs Center, International Data Base, April 26, 2005; International Energy Agency, Energy Balances of OECD Countries, 2006 Edition; EIA International Petroleum Monthly <http://www.eia.doe.gov/pub/international/iealf/table12.xls>.

Strategic & Commercial Stocks

- OECD government-controlled emergency oil stocks: 1.5 billion barrels
- OECD commercial stocks held for strategic purposes: 2.7 billion barrels
- U.S. strategic petroleum reserve: 688 million barrels
- U.S. heating oil reserve: 2.0 million barrels

World Crude Oil Strategic Stocks (Government Controlled)

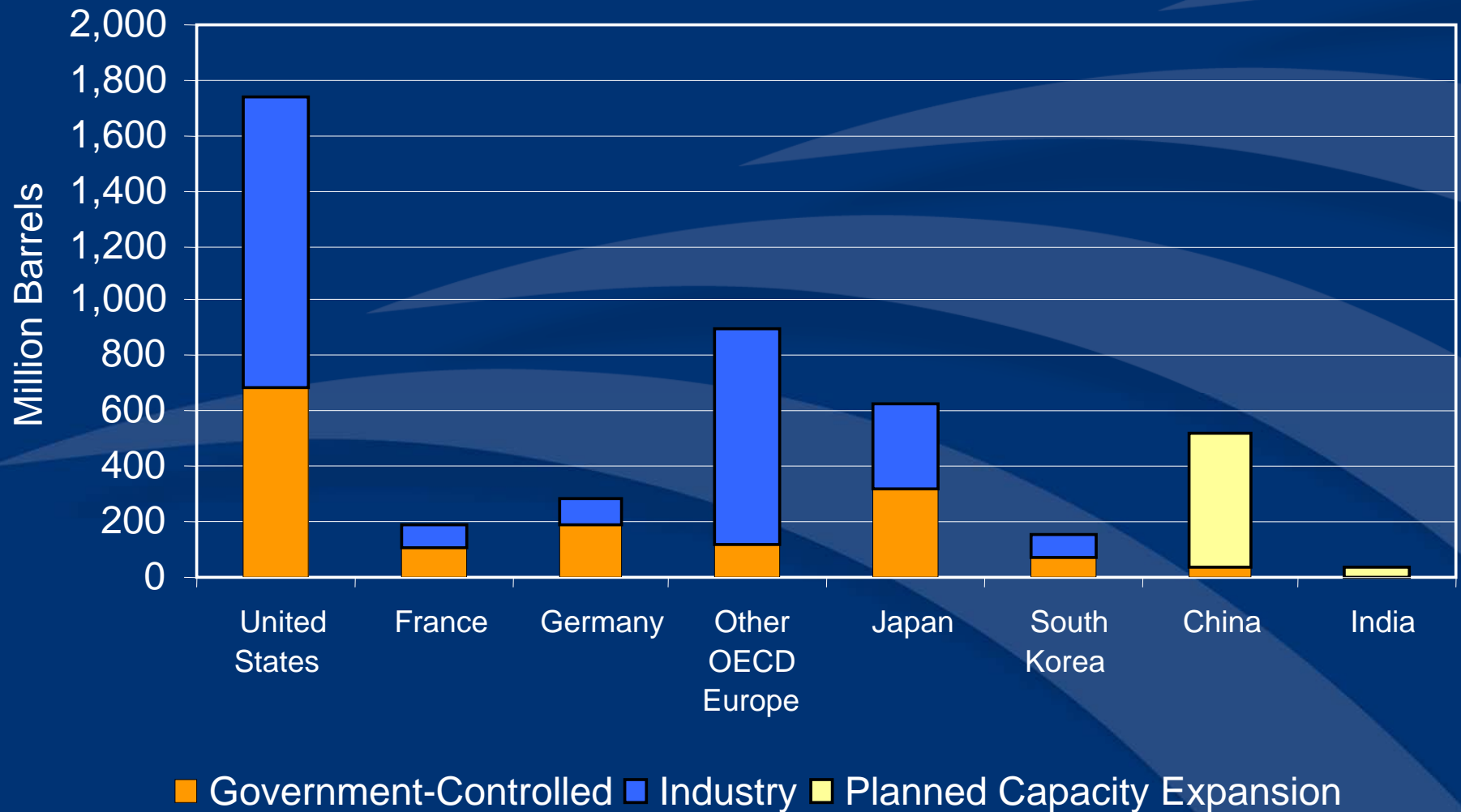


* Data prior to 1984 not available.

** As of July 2006.

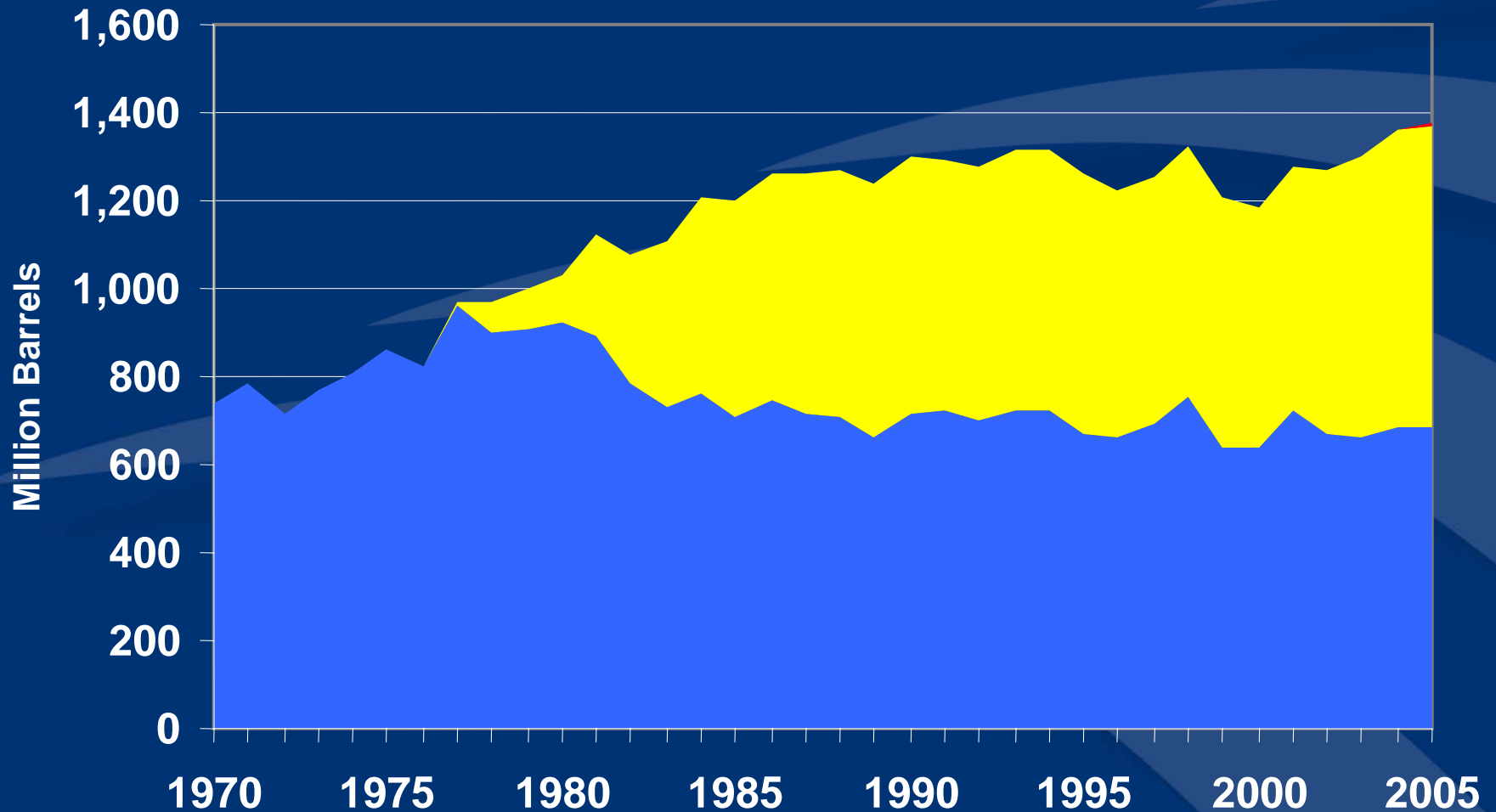
Source: EIA International Petroleum (Oil) Stocks Data
http://tonto.eia.doe.gov/merquery/mer_data.asp?table=T11.03

World Crude Oil Strategic Stocks



Source: EIA International Petroleum (Oil) Stocks Data; Medley Global Advisors Oil Brief "China: Stealth SPR Build," 10/26/2006; Alexander's Gas and Oil Connections "India to Build up Storage of Crude Oil" 9/21/2004.

U.S. Total Oil Stocks & Strategic Petroleum Reserves



■ Commercial Oil Stocks
■ Strategic Home Heating Oil Reserves

■ Strategic Petroleum Reserves

Source: EIA, Annual Energy Review 2005 and
<http://www.fe.doe.gov/programs/reserves/heatingoil/index.html>

Oil Markets & Prices

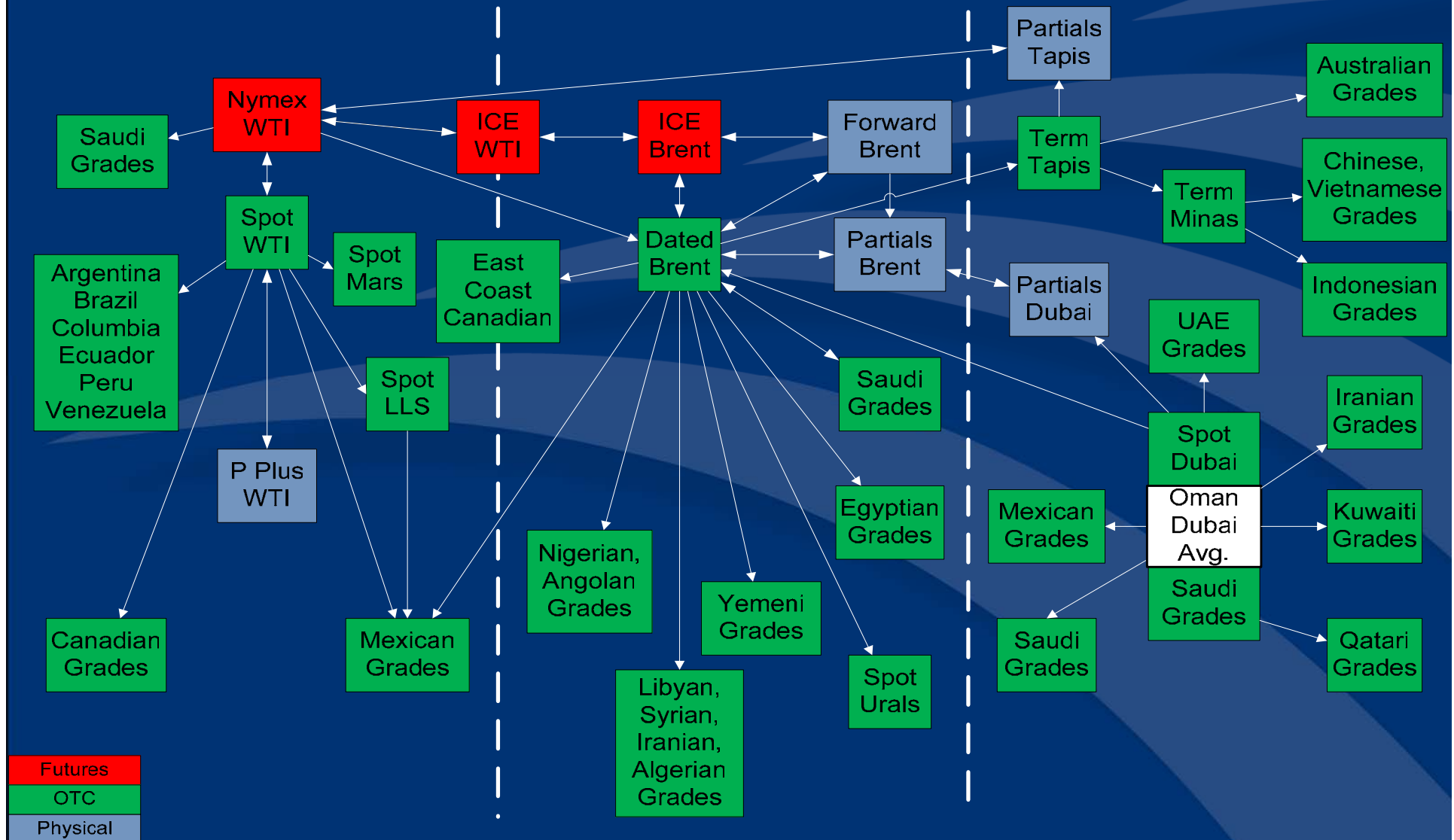
- Trade in oil is global and integrated
- Physical & financial markets:
 - Global transactions valued at ~\$2.5 trillion/year
- Physical transactions: ~\$167 billion
- Futures transactions: ~\$299 billion
- Over the Counter (OTC) transactions 3-5 fold larger than physical/futures trade

World Petroleum Market Structure

Americas

Europe/Africa

Asia

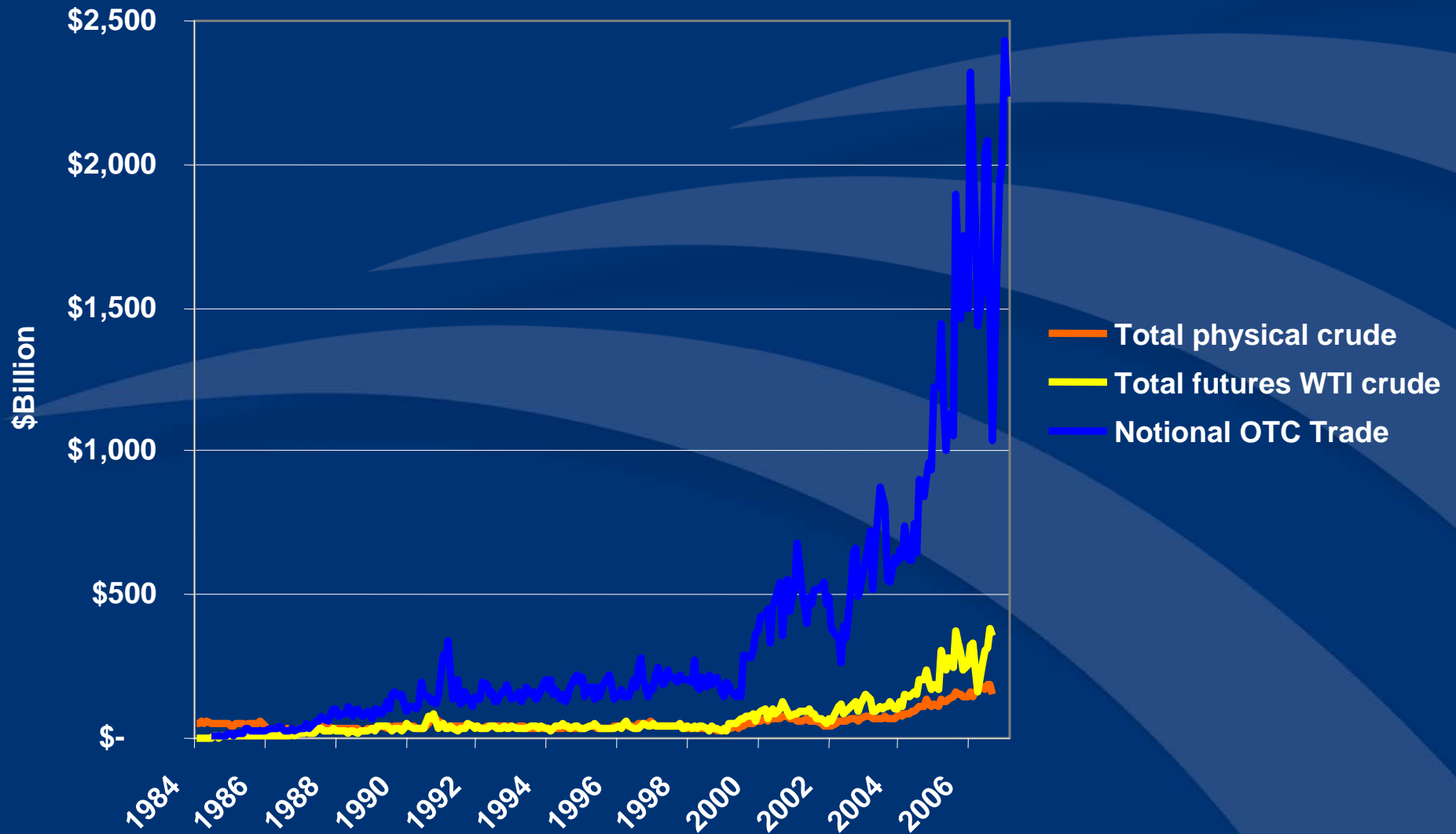


Definitions: ICE – Intercontinental Exchange; OTC – Over the counter; WTI – West Texas Intermediate; Partial – an artificial unit of 25,000 barrels of Oman and Dubai crude; Dated Brent – cargoes with specific loading dates; TAPIS – a crude oil field in Malaysia that serves the same trading purpose as WTI.

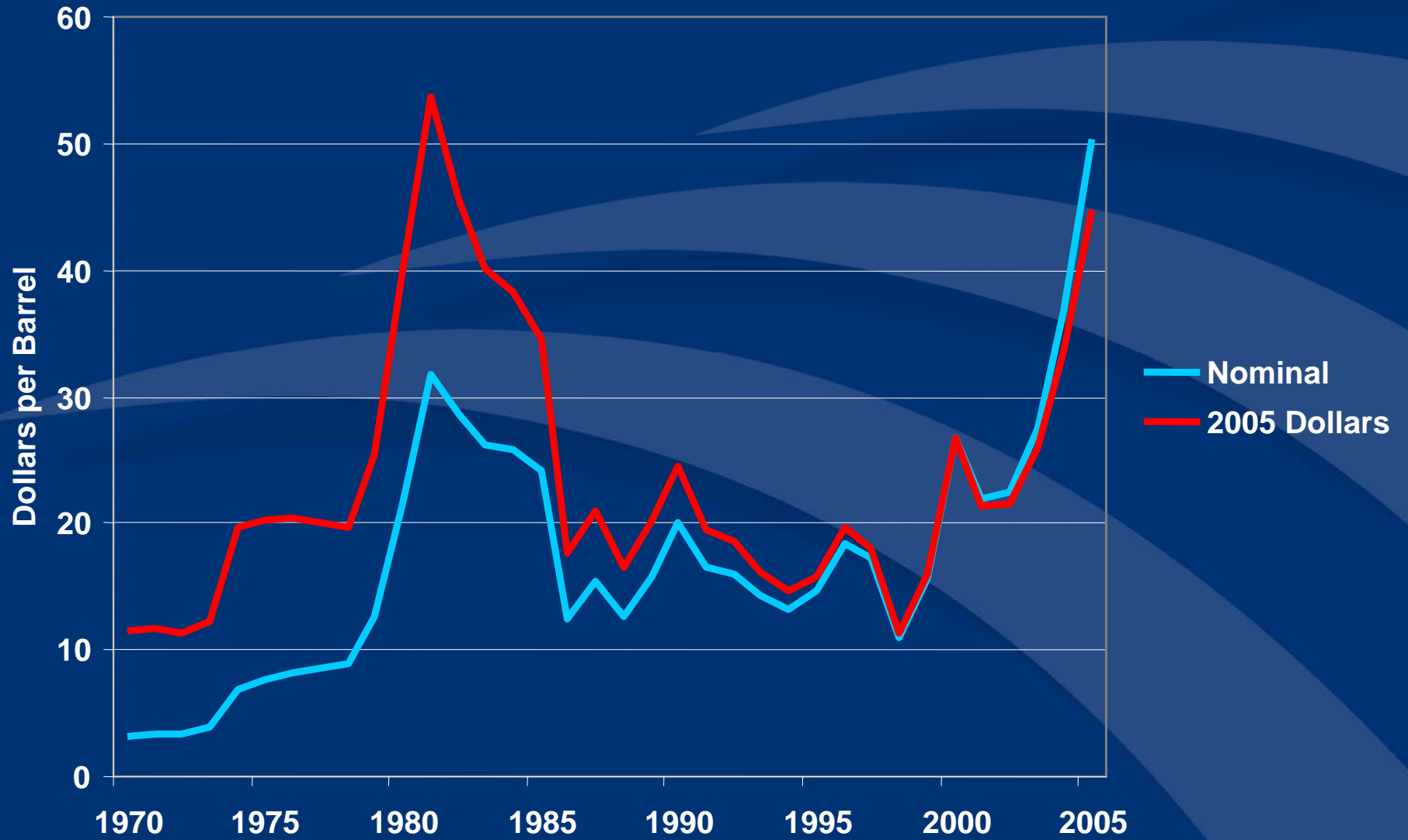
Source: ESAI

Physical and Financial Oil Markets

(ESAI)

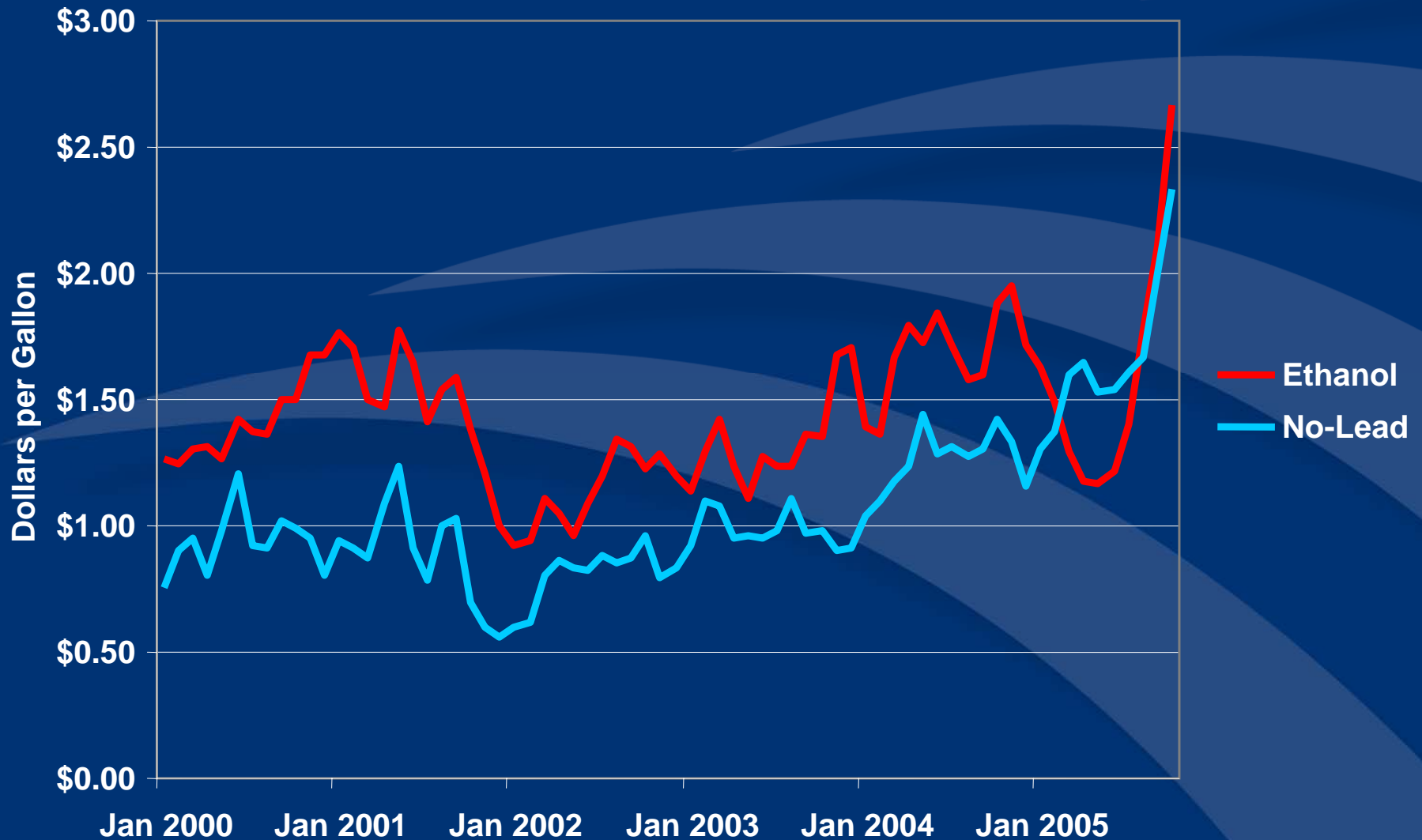


U.S. Crude Oil Prices



Source: EIA Annual Energy Review 2005, Crude Oil Domestic First Purchase Prices.

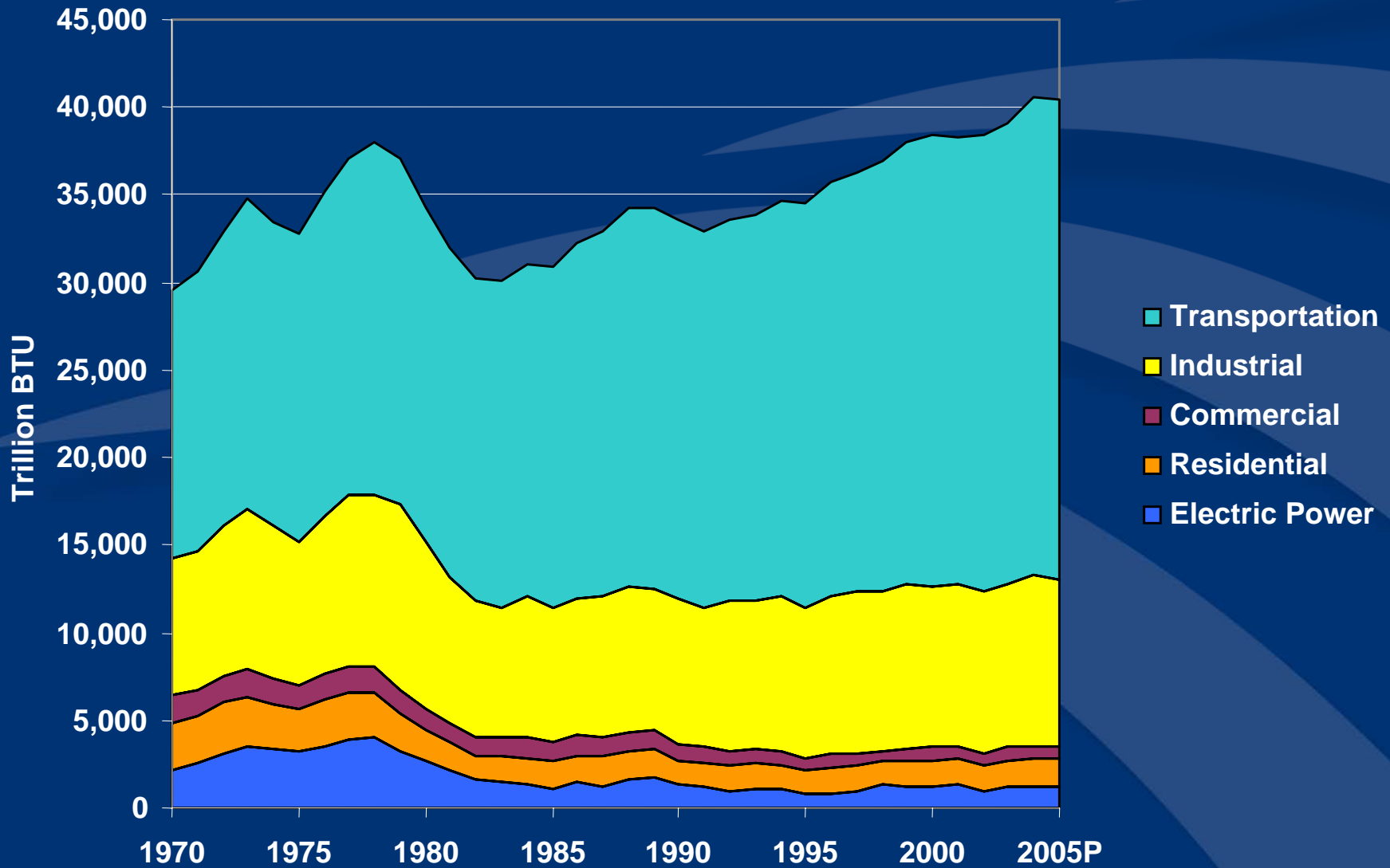
Gasoline and Ethanol Wholesale Prices, January 2000 – September 2005



Transportation sector

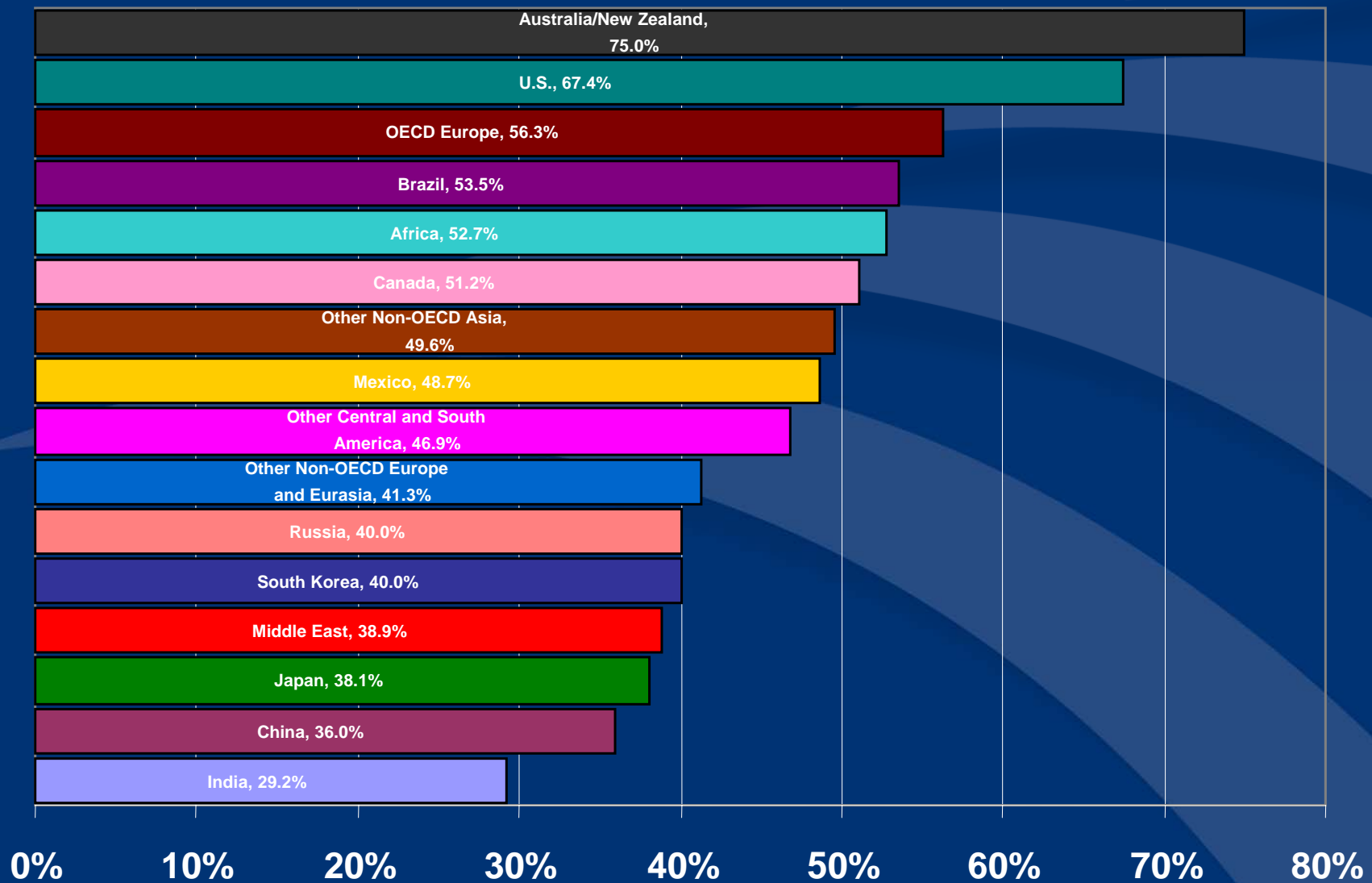
- Oil consumption
 - U.S. per capita consumption tracks fuel economy
 - U.S. per capita consumption nearly double EU-15 per capita consumption
- U.S. on-road fuel economy largely unchanged since 1981
- Alternative fuels capability
 - U.S. AFV fleet approaching 600,000 units
 - U.S. ethanol production capacity ~ 3.9 billion gallons

U.S. Energy Consumption by Sector

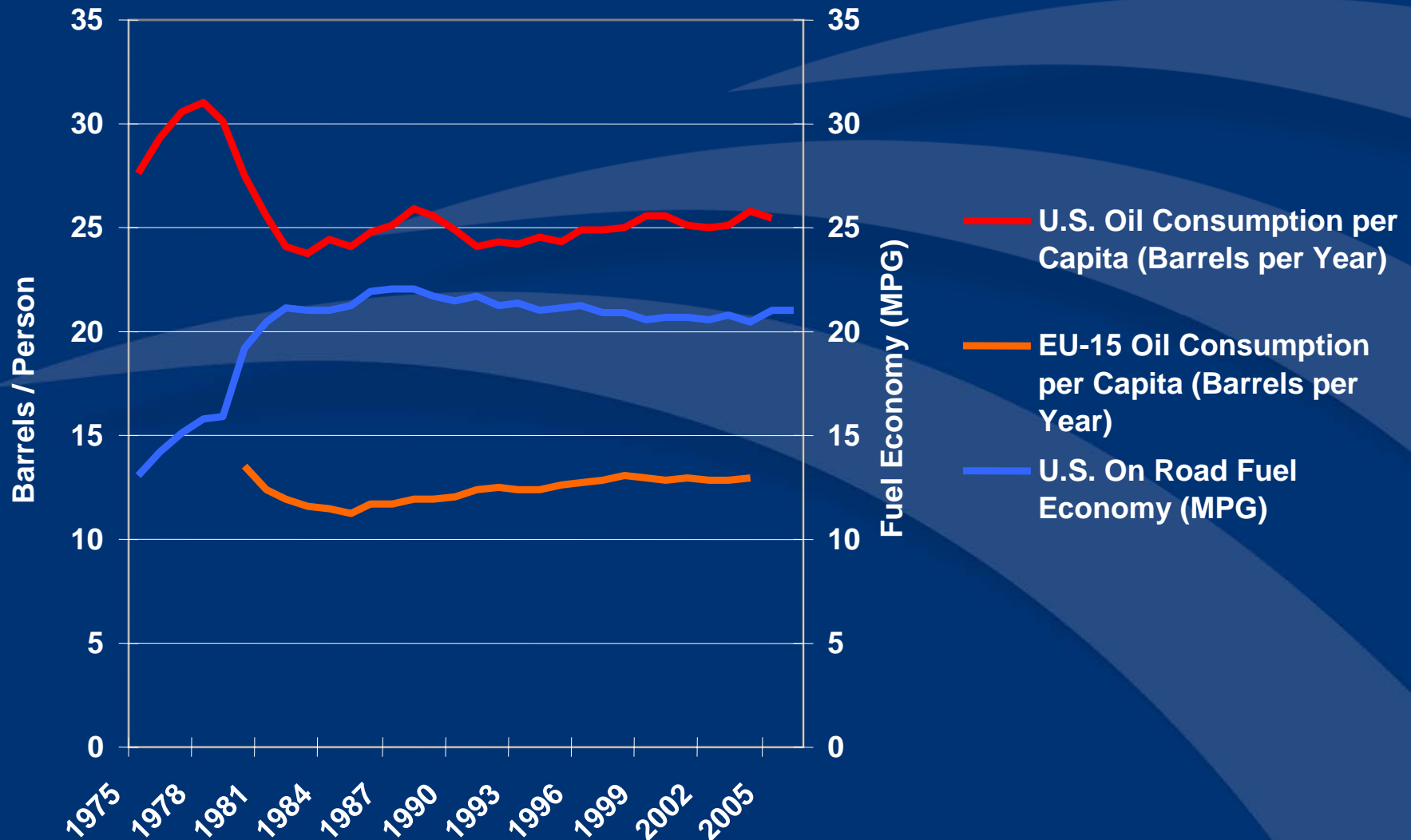


Source: EIA Annual Energy Review, Energy Consumption by Sector

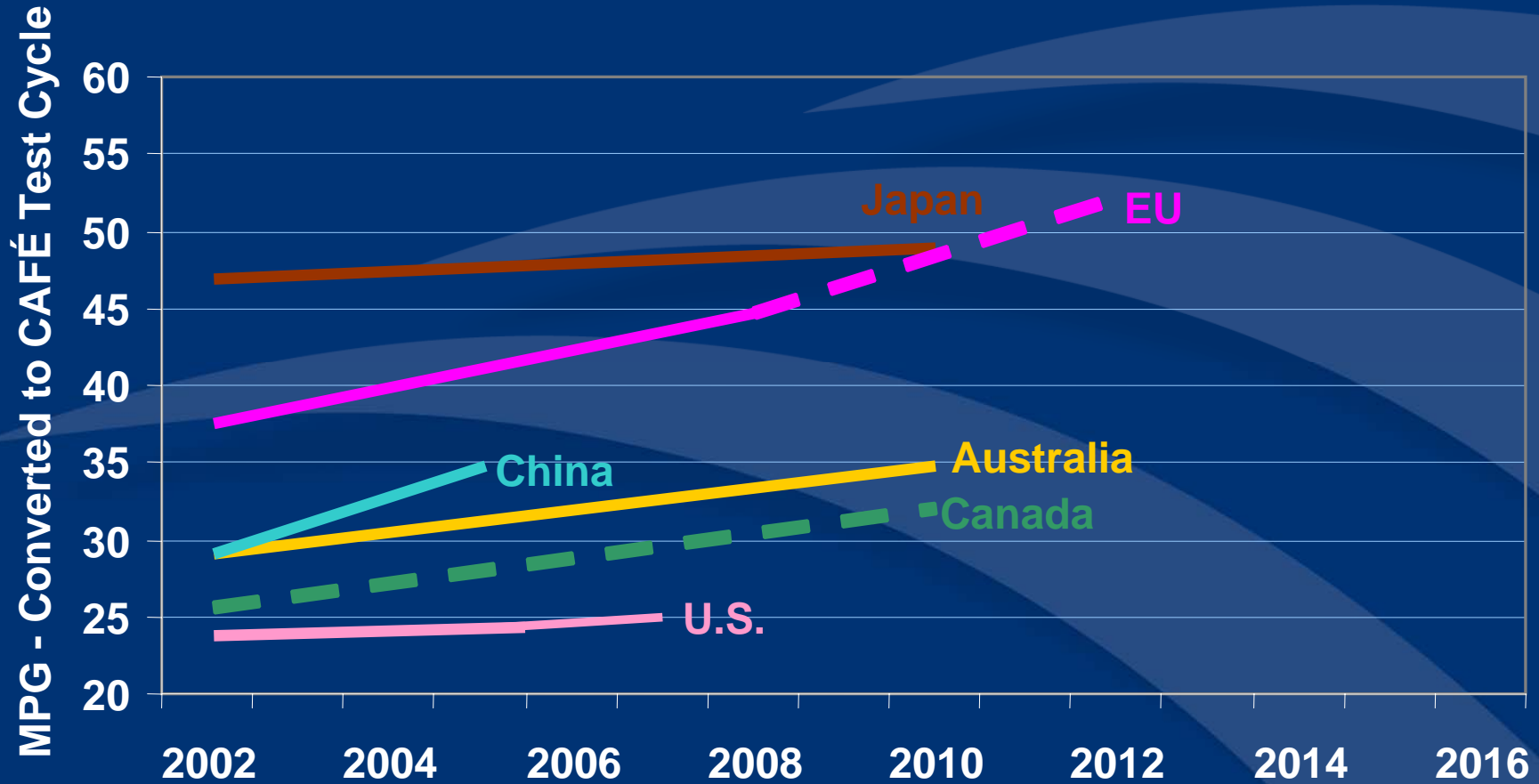
Transport as Share of Oil Consumption (2003)



U.S. - EU-15 Actual On-Road New Vehicle Fuel Economy and Per Capita Oil Consumption

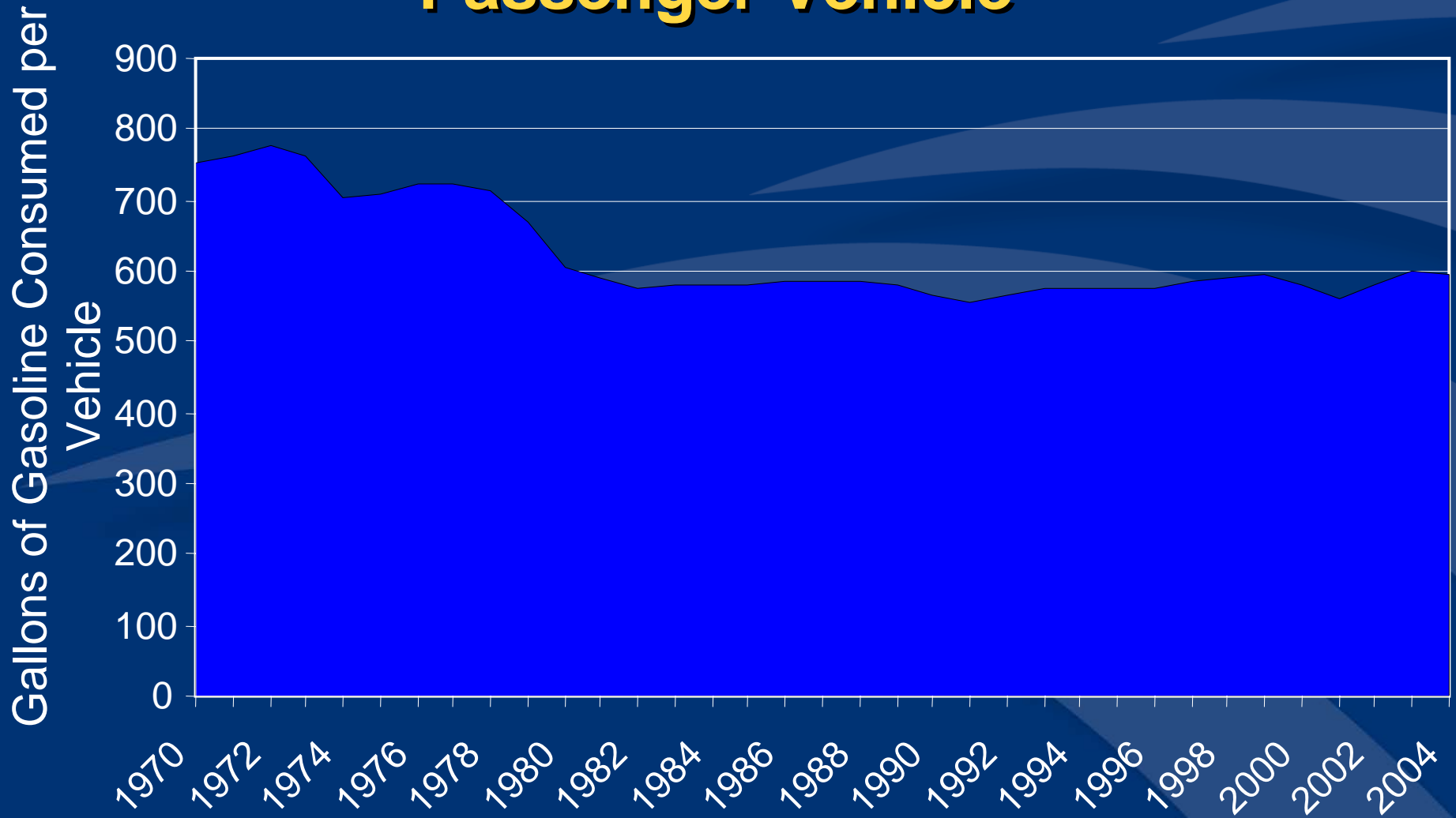


Comparison of Projected Fuel Economy Standards



Adapted from An and Sauer, Comparison of Passenger Vehicle Fuel Economy and Greenhouse Gas Emission Standards Around the World. Pew Center on Global Climate Change, December 2004.

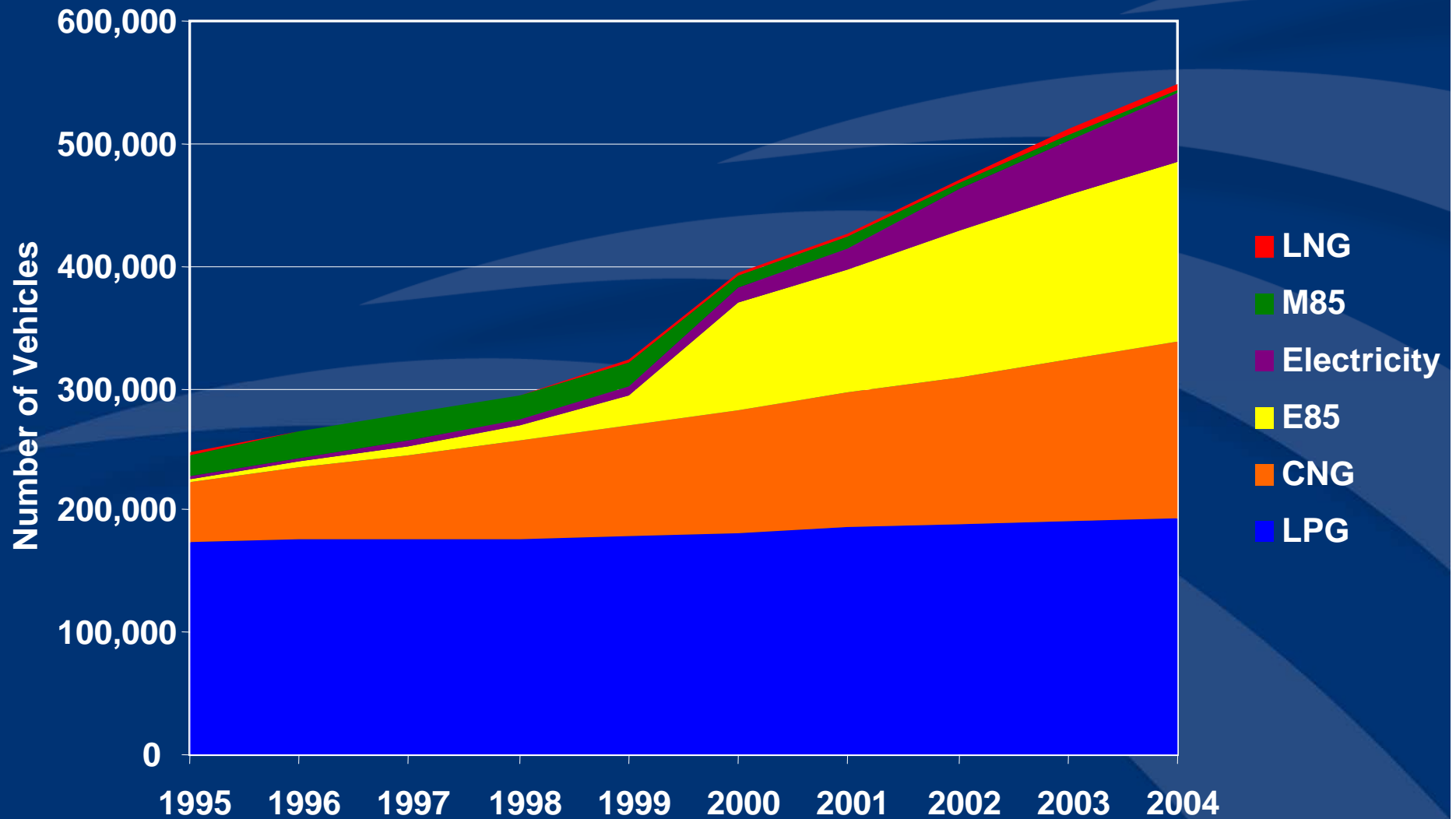
U.S. Annual Gasoline Consumption per Passenger Vehicle



Note: Data includes gasoline consumed by Motorcycles, Passenger Vehicles, and Other 2-Axle 4-Tire Vehicles.

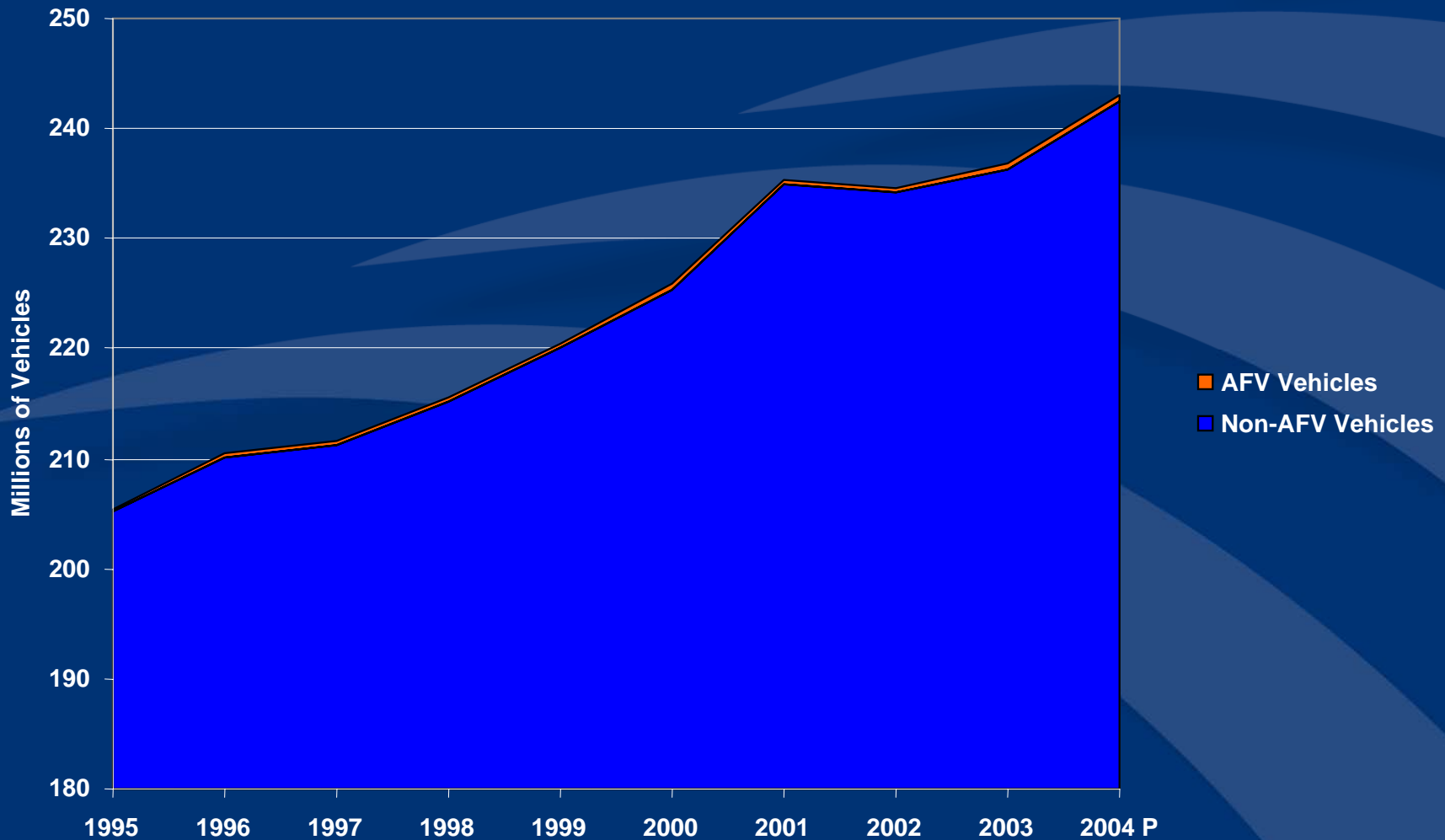
1960-94: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics Summary to 1995, <http://www.fhwa.dot.gov/ohim/summary95/index.html>, as of July 28, 2000, table VM-201A. 1995-2004: BTS National Transportation Statistics, Fuel Consumption by Mode of Transportation in Physical Units, http://www.bts.gov/publications/national_transportation_statistics/html/table_04_05.html and http://www.bts.gov/publications/national_transportation_statistics/excel/table_01_11.xls.

U.S. AFV Fleet Composition



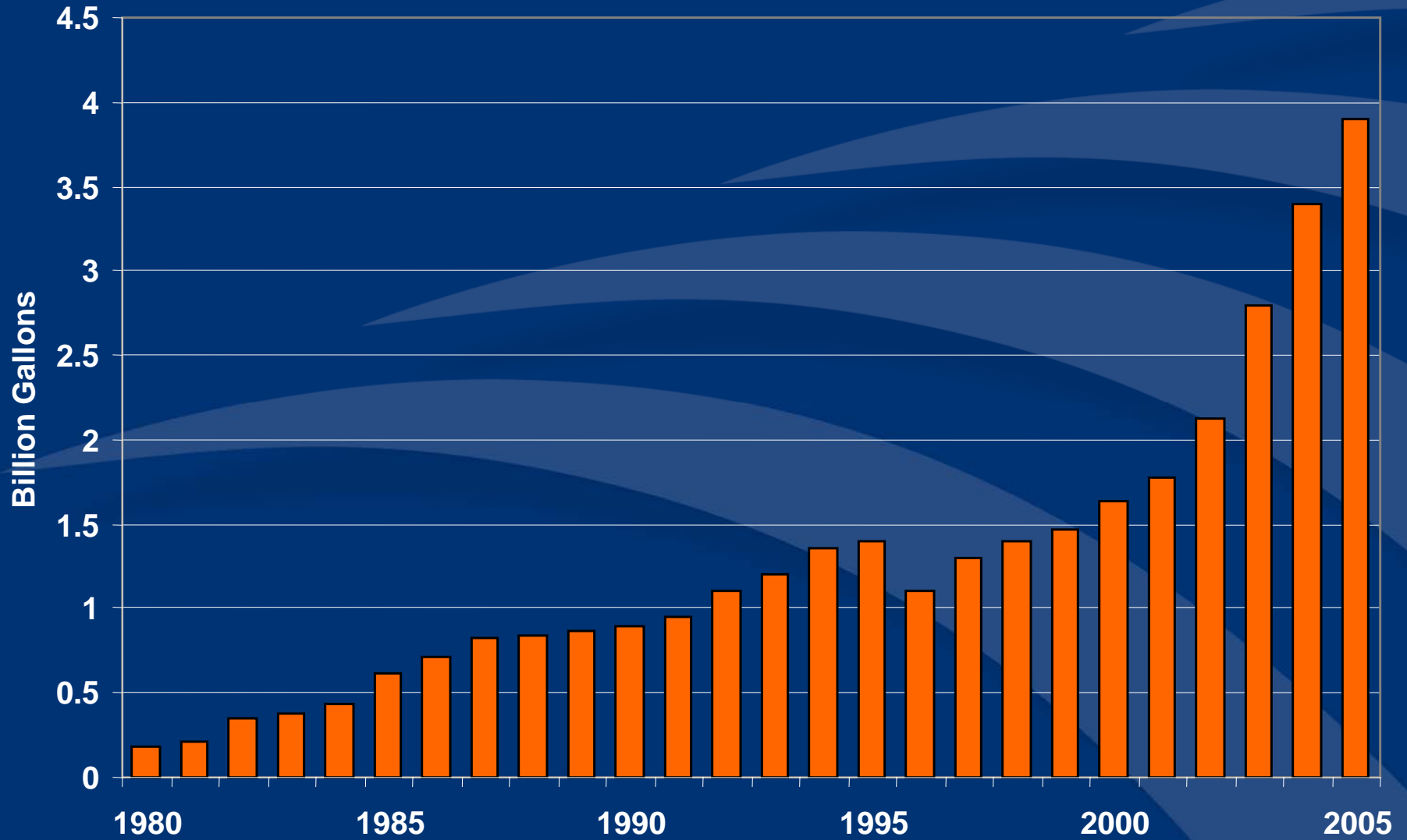
Source: Estimated Number of Alternative-Fueled Vehicles – EIA,
http://www.eia.doe.gov/cneaf/alternate/page/datatables/aft1-13_03.html.

U.S. Vehicle Fleet and Fuel Flexible Vehicle Fleet



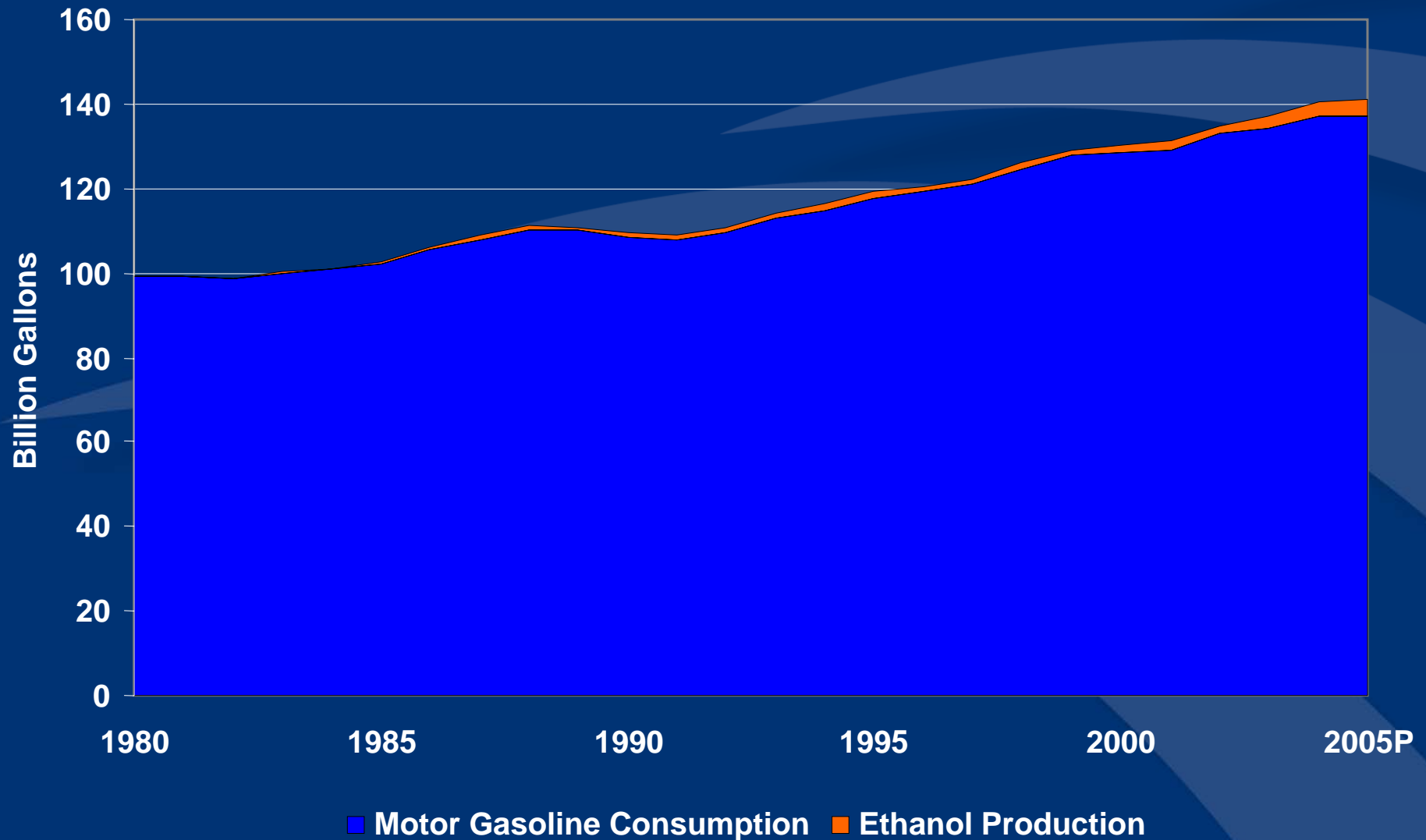
Source: Estimated Number of Alternative-Fueled Vehicles – EIA,
http://www.eia.doe.gov/cneaf/alternate/page/datatables/aft1-13_03.html; Total U.S. Fleet – USDOT BTS,
http://www.bts.gov/publications/national_transportation_statistics/html/table_01_11.html.

Ethanol Production Capacity



Source: Renewable Fuels Association,
<http://www.ethanolrfa.org/industry/statistics/#A>

U.S. Motor Gasoline Consumption Ethanol Production Capacity

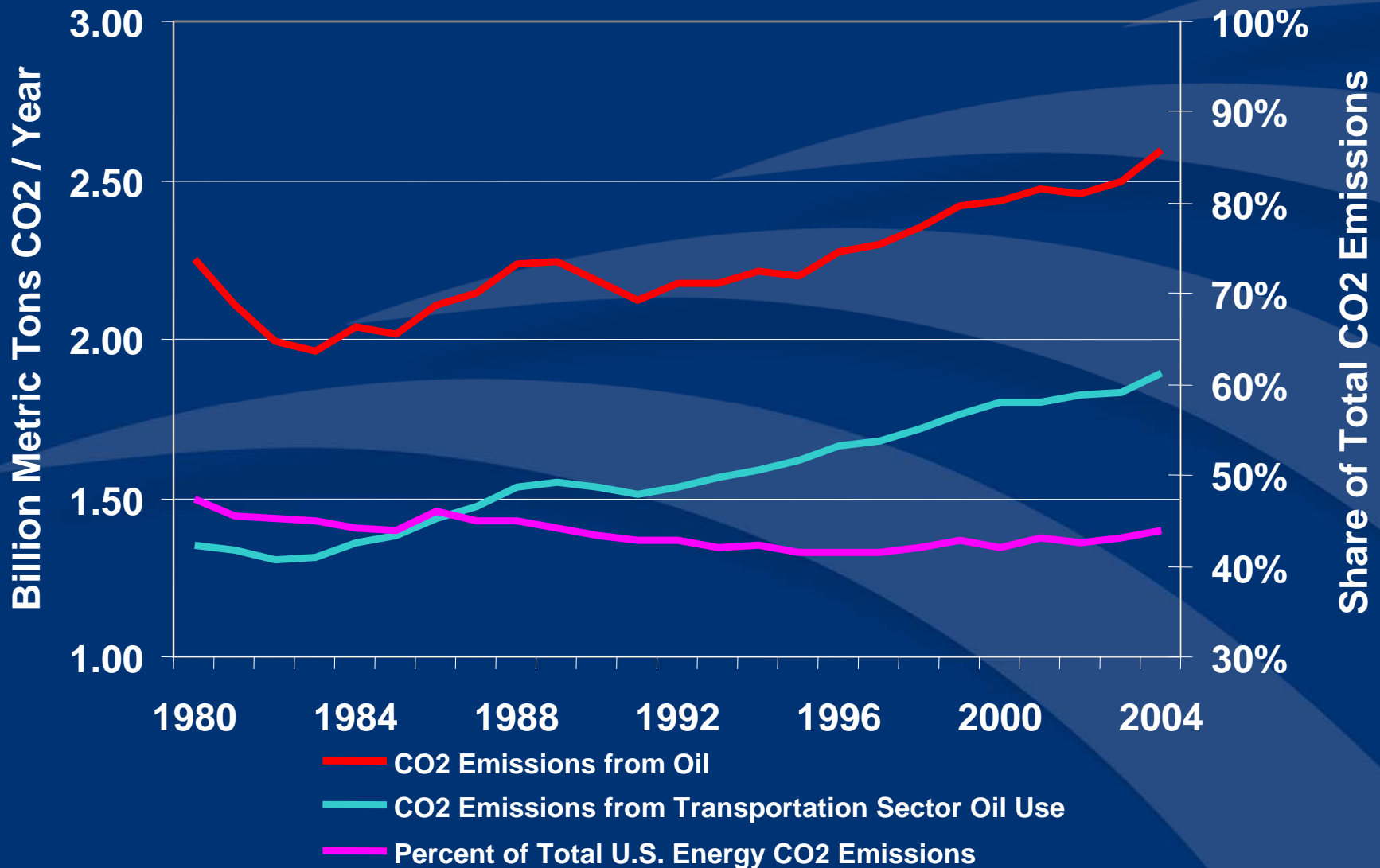


Source: EIA Annual Energy Review, <http://www.eia.doe.gov/emeu/aer/txt/ptb0513c.html>

Petroleum Sector Emissions

- Petroleum sector SO_x emissions: __ Short Tons
- Petroleum sector NO_x emissions: __ Short Tons
- Petroleum sector CO₂ emissions: 2.6 Billion Metric Tons
- Transportation sector CO₂ emissions: 1.9 Billion Metric Tons

U.S. CO2 Emissions from Oil



Sources: EIA, International Petroleum (Oil) Consumption <http://www.eia.doe.gov/emeu/international/oilconsumption.html>;
EIA, Environment http://www.eia.doe.gov/oiaf/1605/ggrpt/excel/historical_co2.xls

PSI Development

- DOE/EIA
- CATO
- Brookings Institution
- National Defense University
- Harvard/JFK School
- Stanford University
- Oak Ridge National Laboratory
- Columbia University
- Duke University
- Johns Hopkins University/SAIS
- Council on Foreign Relations
- World Resources Institute
- University of Texas-Austin/CEE
- Resources for the Future
- International Monetary Fund
- CSIS
- Institute for International Economics
- Colorado School of Mines
- Rand Corporation
- University of California/Berkeley

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