

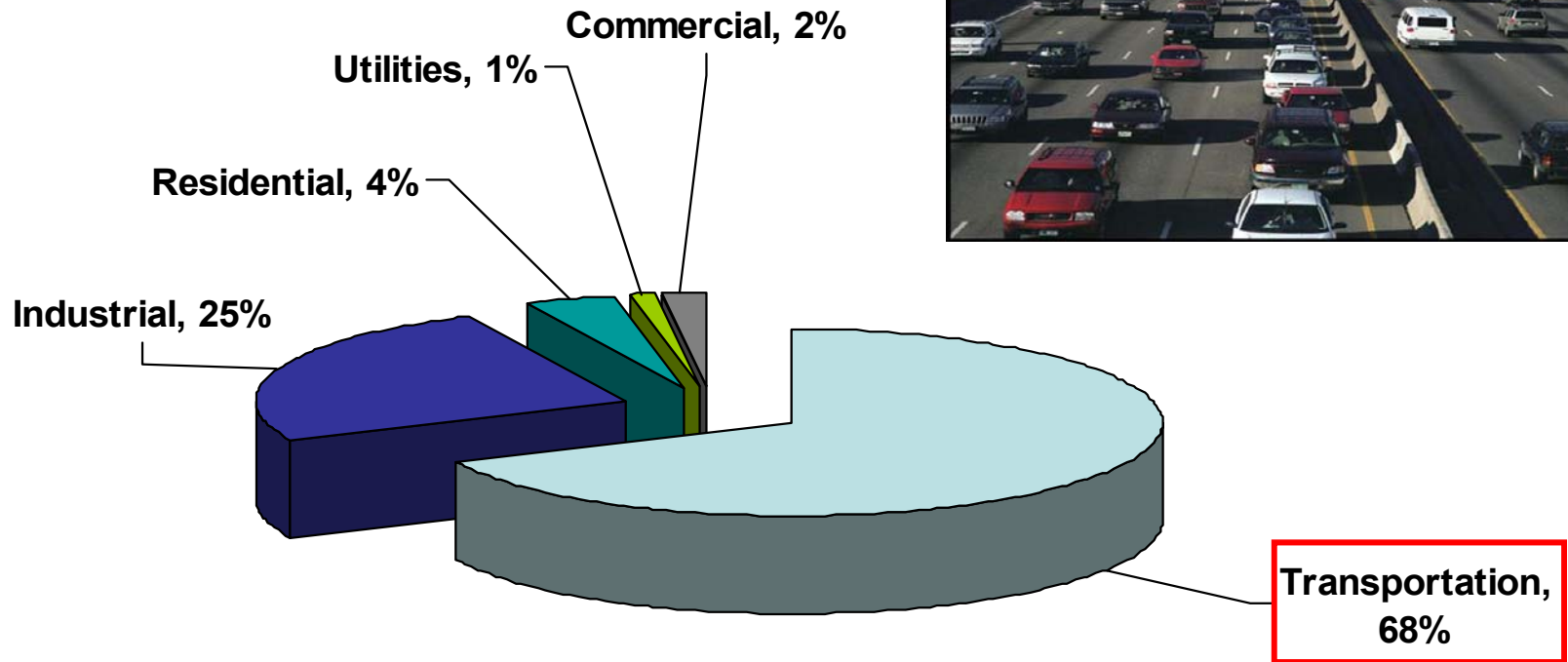
Why the Time is Right to Deploy Alternative Fuels

Tucson Leadership Forum
9-14-07

Gerry Harrow
National Renewable Energy Laboratory

Oil Use

Globally 80 MB/day
Nationally 21 MB/day



Data Source: EIA Annual Energy Review 2006

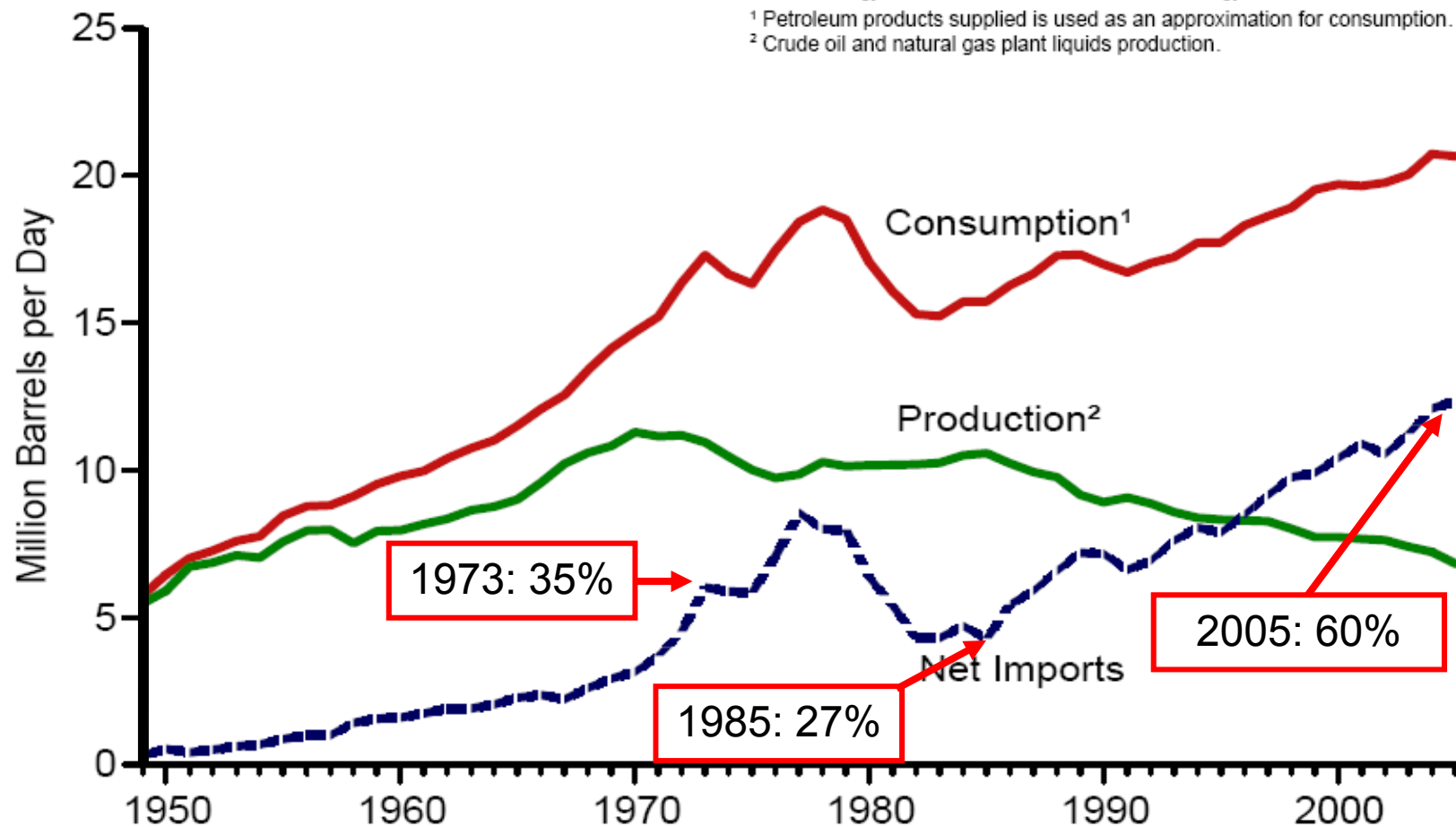
U.S. Consumption Grows While Production Declines

Overview, 1949-2005

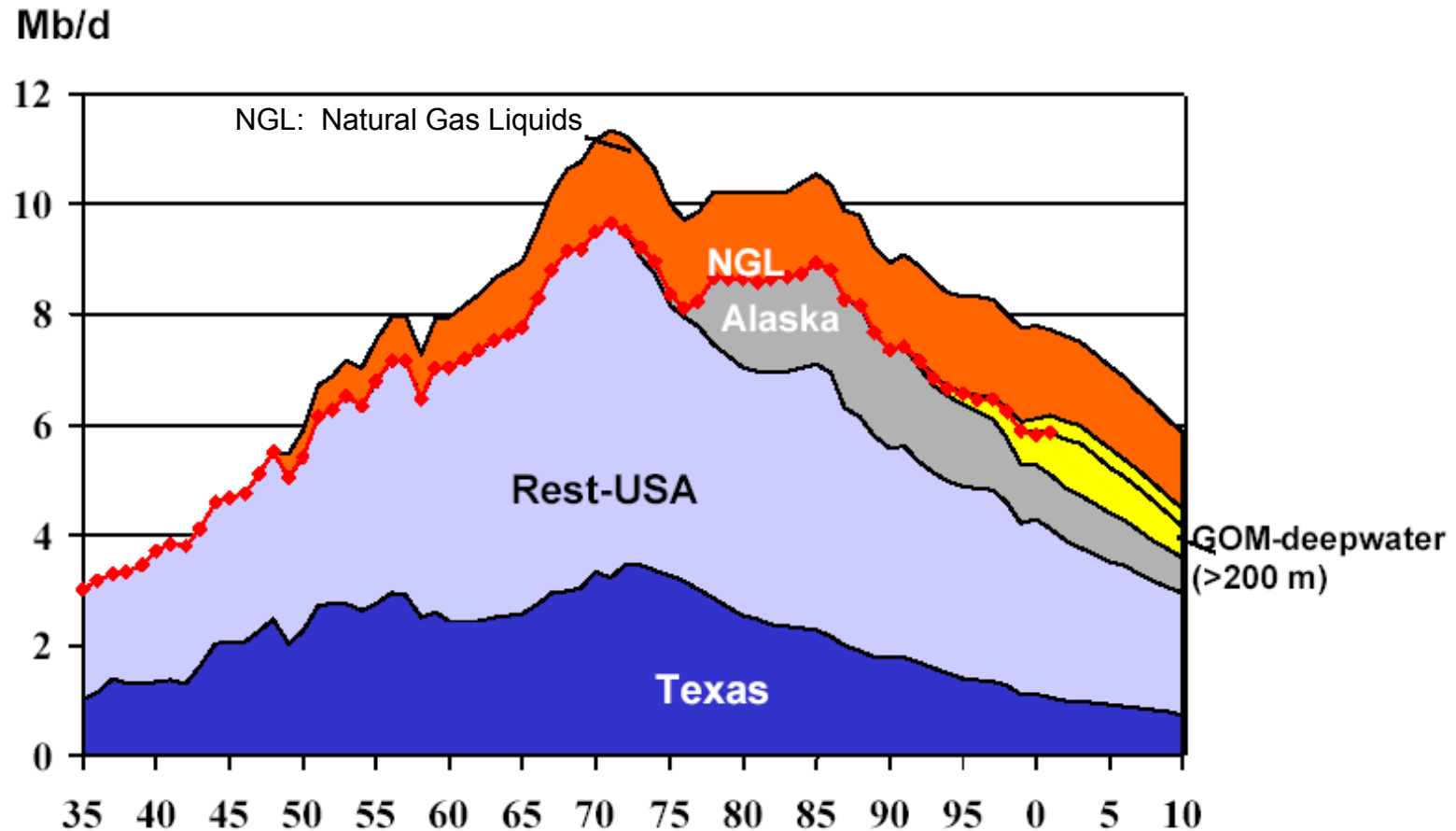
Energy Information Administration / Annual Energy Review 2005

¹ Petroleum products supplied is used as an approximation for consumption.

² Crude oil and natural gas plant liquids production.



U.S. Oil Production Peaked in Mid-70's

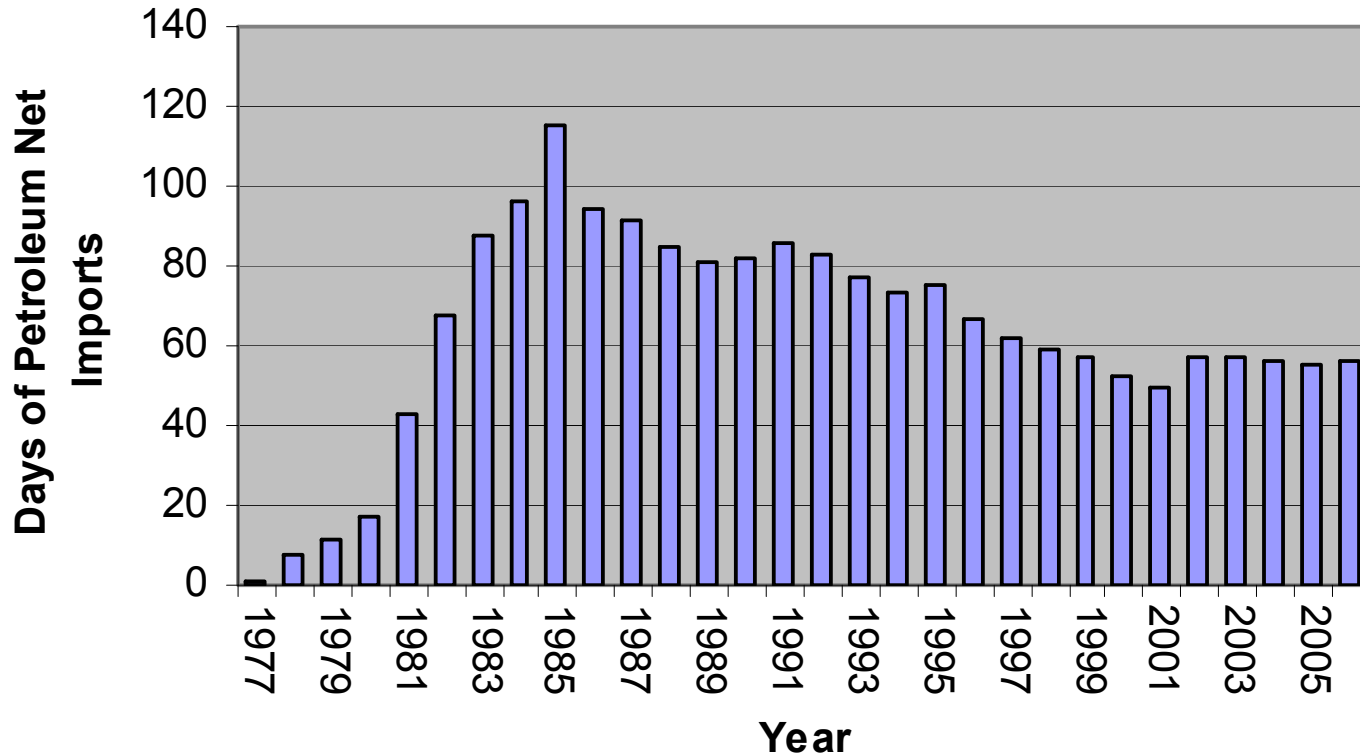


Gene Cooperman, <http://www.ccs.neu.edu/home/gene/peakoil/node1.html>

Source: Texas Railroad Commission, US Energy Information Administration

Strategic Petroleum Reserve

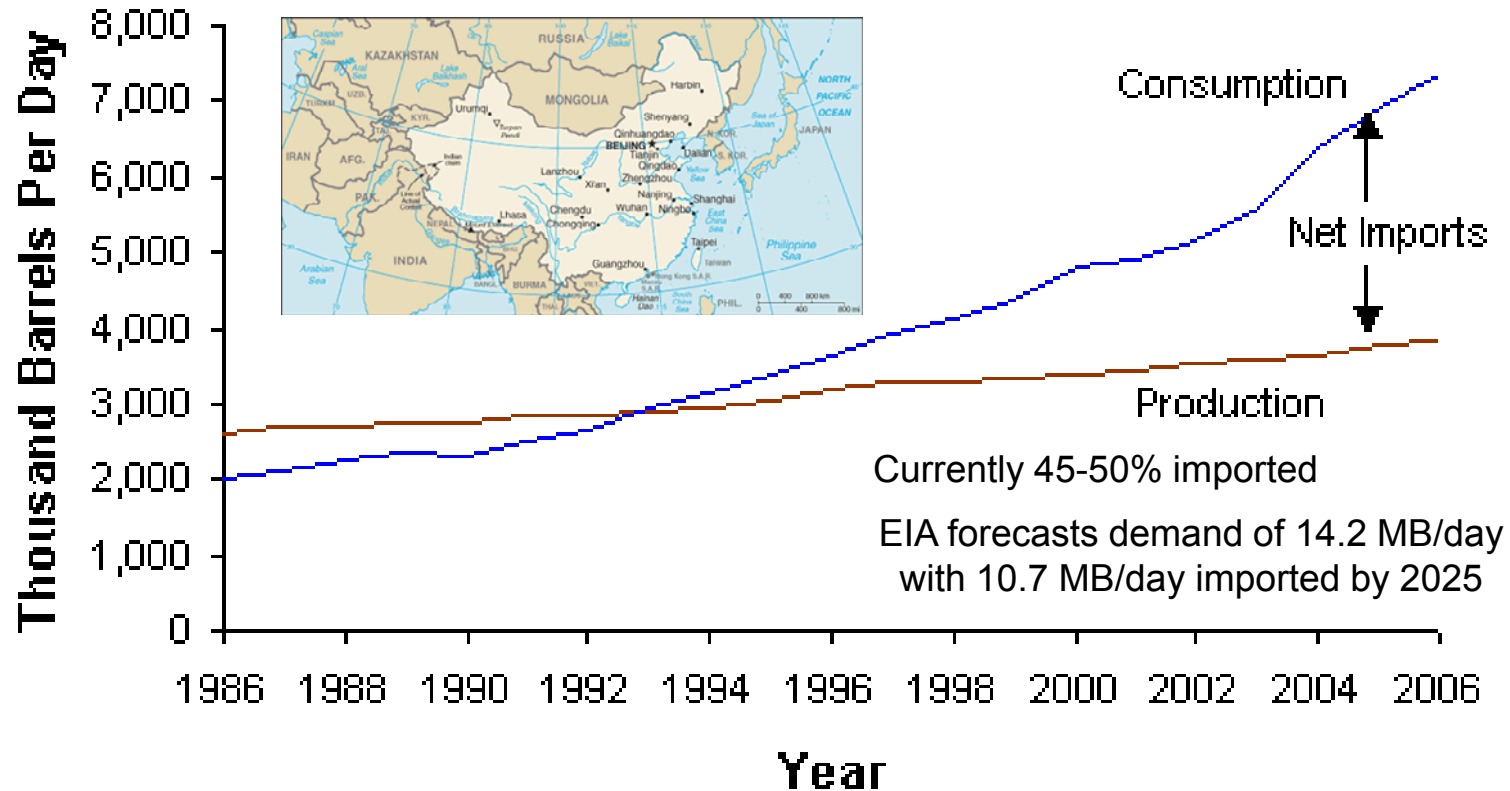
U.S. Strategic Reserves



Sources: **Imported by SPR and End-of-Year Stocks, Quantity:** 1977-1980 Energy Information Administration (EIA), Energy Data Report, *Petroleum Statement, Annual*, annual reports. 1981-2005 EIA, *Petroleum Supply Annual*, annual reports. 2006 EIA, *Petroleum Supply Monthly* (February 2007). **Imported by Others, Domestic Crude Oil Receipts, and Withdrawals:** U.S. Department of Energy, Assistant Secretary for Fossil Energy, unpublished data.

China – Significant Growth

China's Oil Production and Consumption, 1986-2006*

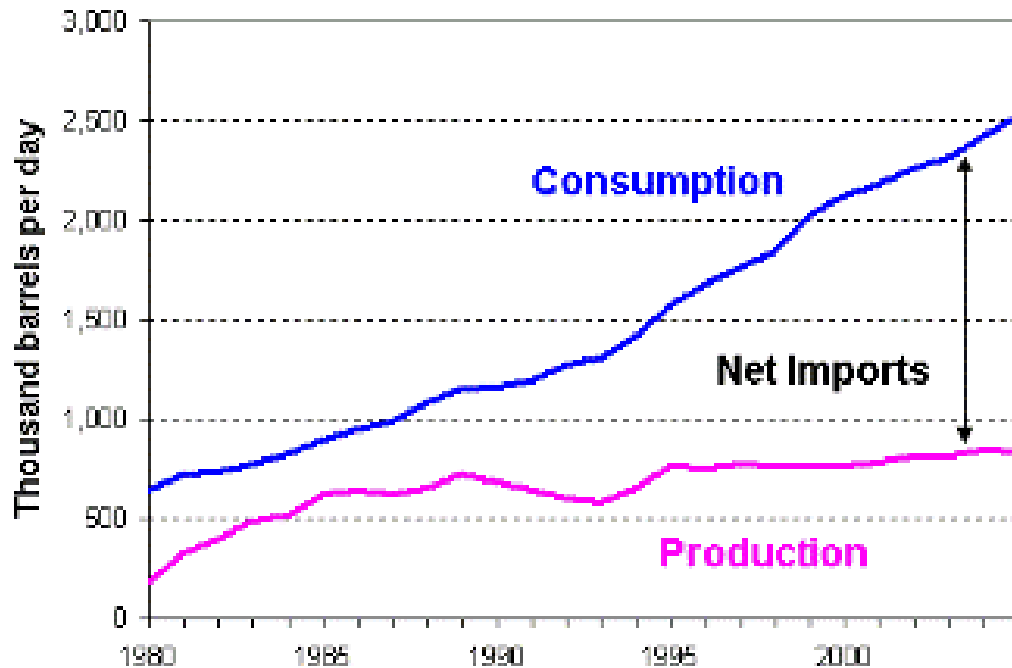


Source: EIA *International Petroleum*

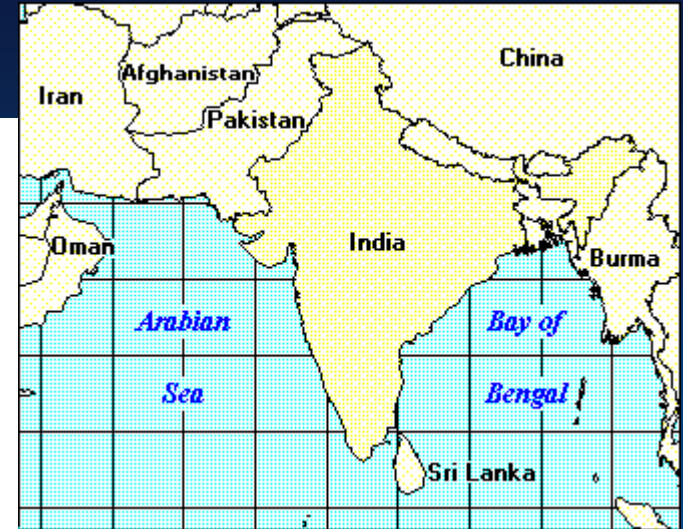
*2006 is Jan-Aug only

India's Growth

India's Oil Production and Consumption, 1980-2005



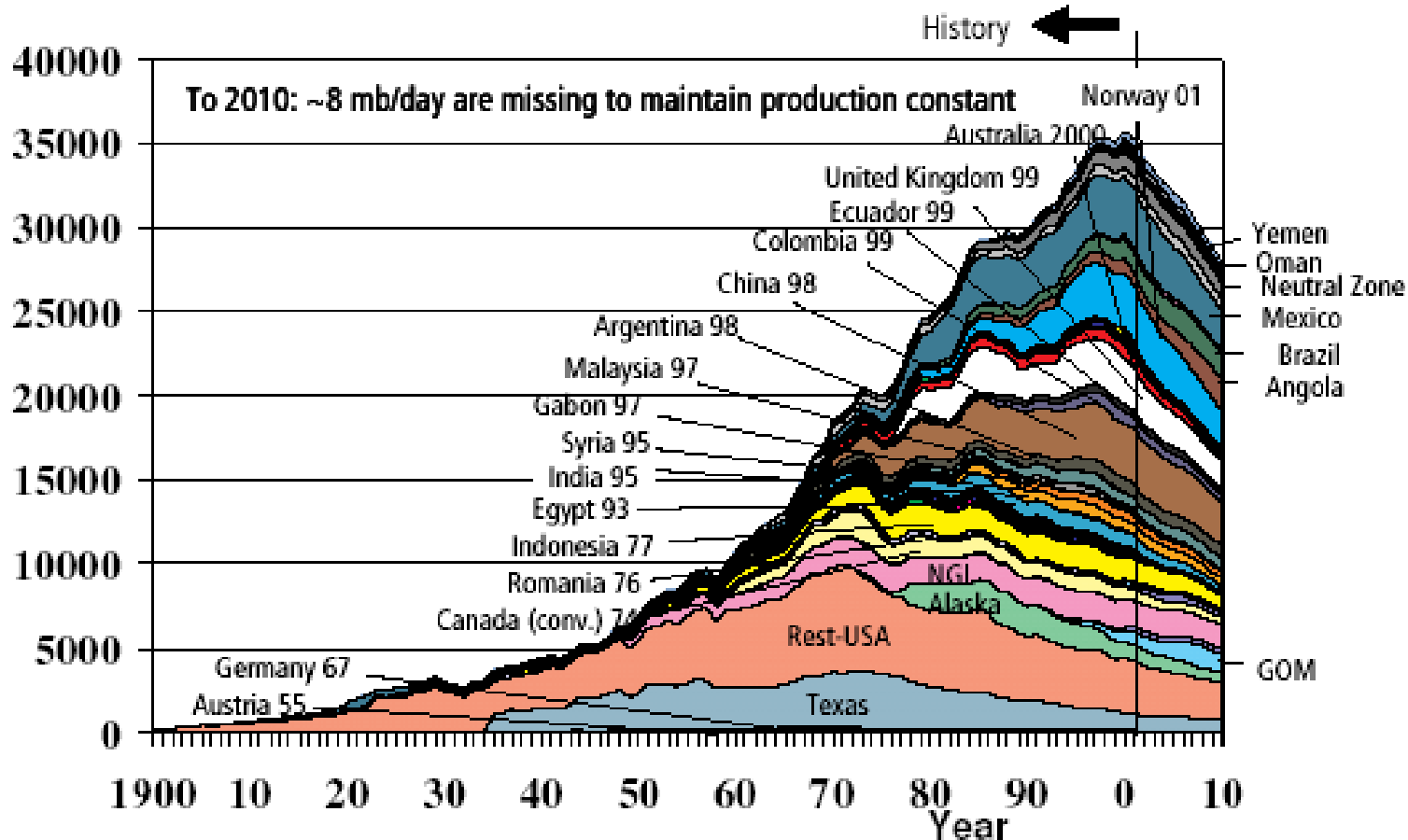
source: EIA



Peak Oil Production

1000 Barrel per day

Gene Cooperman,
<http://www.ccs.neu.edu/home/gene/peakoil/node1.html>



Source: Industry data base, 2003; Analysis: LBST

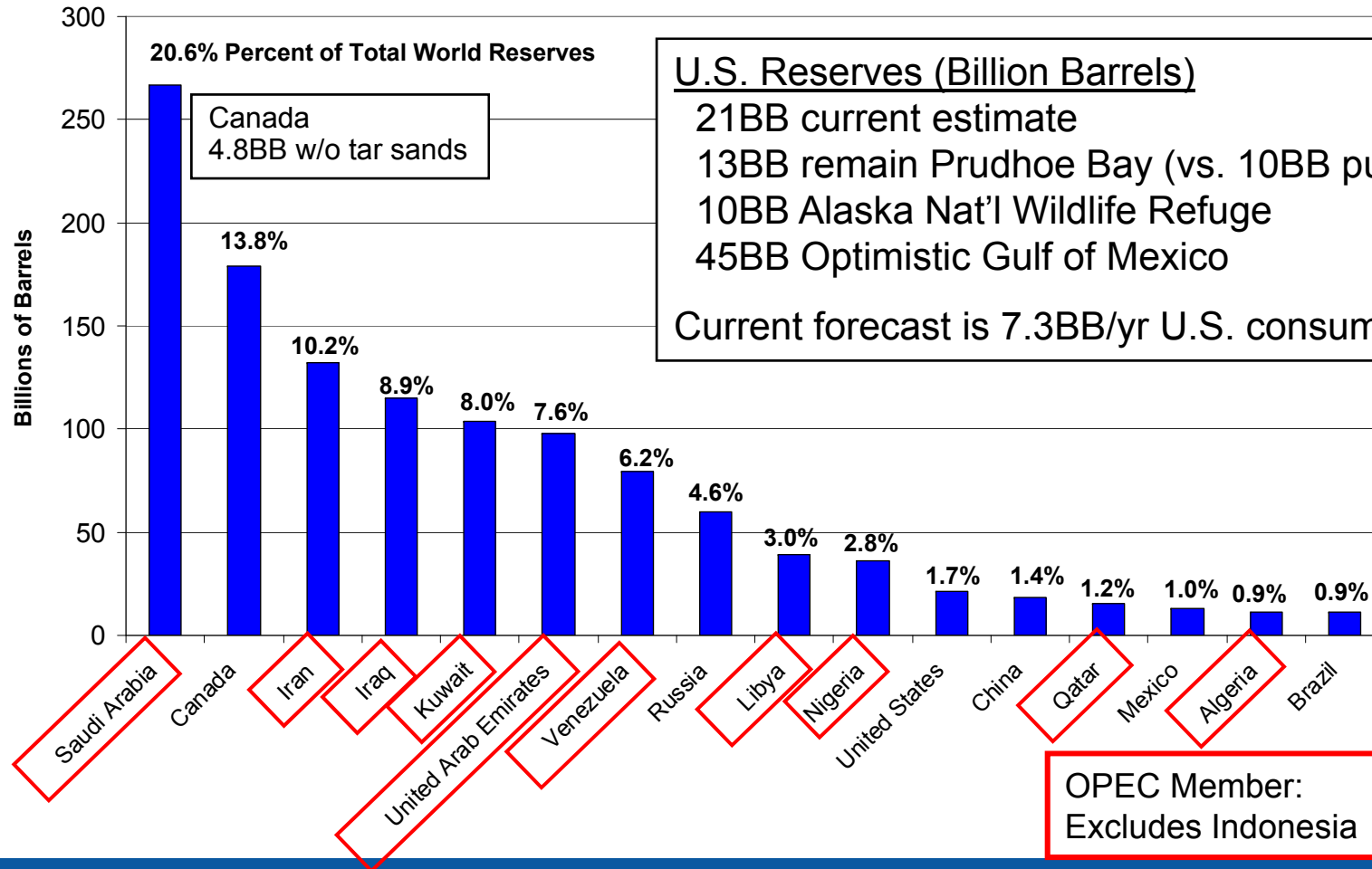
World excl. OPEC, former Soviet Union and non-conventional Canadian oil (tar sands). (Peak years for each country are shown.); The peak 35 million barrels per day is 42% of world production. SOURCE: Salzburg 2003 Summer School

NGL = Natural Gas Liquids including ethane, propane, butane, and sulfur, are derivatives of natural gas, extracted during gas refining.

Proven Reserves, 2006

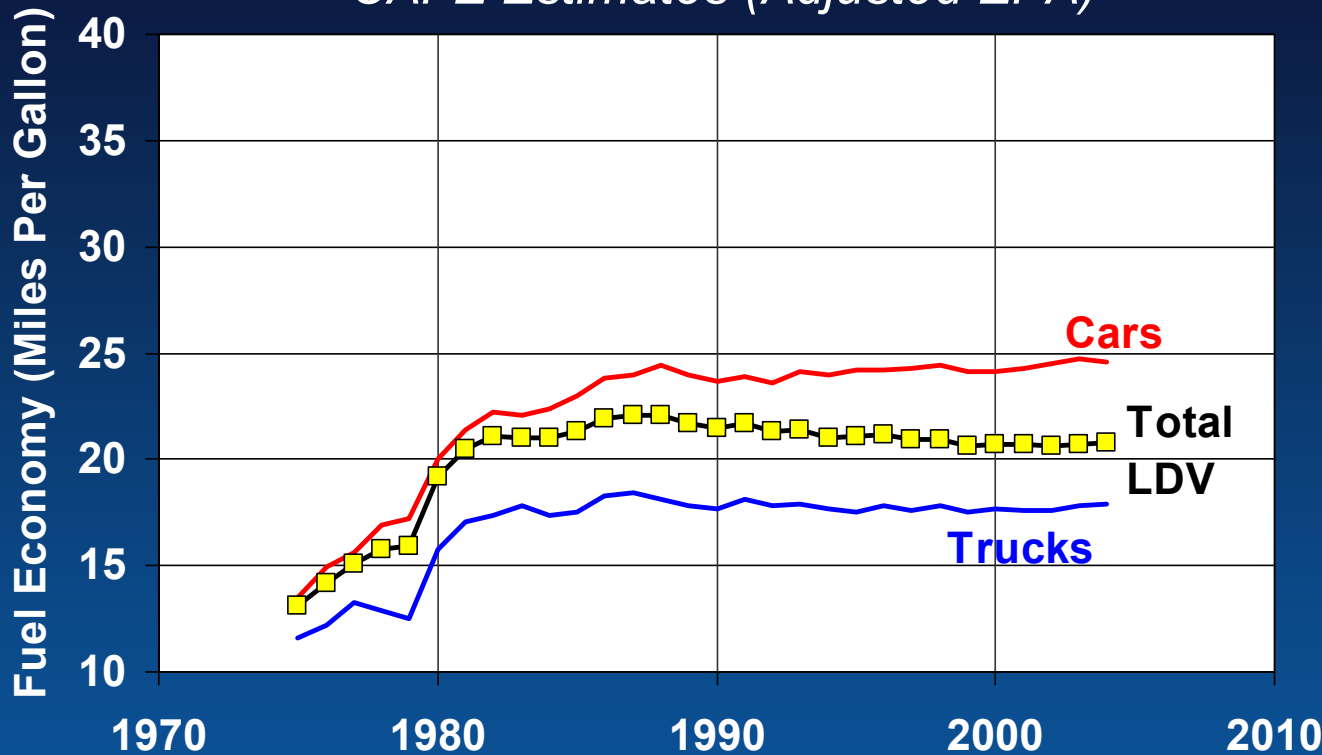
World Total ~1.3 Trillion Barrels

Energy Information Administration / Annual Energy Review 2005



What's Happened with Fuel Economy?

CAFE Estimates (Adjusted EPA)



Source: U.S EPA, Light-Duty Automotive and Fuel Economy Trends: 1975-2004, 4/04.

... from 1981 to 2003, fuel economy dropped by 1%, weight is 24% heavier, horsepower is 93% higher and 0-60 time is 29% faster

Source: Hellman and Heavenrich, EPA 2003

Federal Incentives

- EPA Act of 1992 as amended by EPA Act of 2005
 - Requires certain regulated fleets of 50 or more LDV's, located in Metropolitan Service Areas, and centrally fueled to buy alt fuel LD vehicles
- Executive Order (E.O.) 13423 signed in 2007
 - Requires certain federal fleets to decrease petroleum consumption by 2% per year relative to their fiscal year (FY) 2005 baseline through FY 2015. Also requires agencies to increase alternative fuel use by 10% per year relative to the previous year.
- Infrastructure tax credits
 - 30% up to \$30,000
- Hybrid and Alternative fuel vehicle tax credits (EPA Act 2005)
 - Depending on model and # of units sold
 - Hybrid tax credits ranges from \$400 to \$2,400 for LD and \$7,500 to \$30,000 for HD
 - Alternative Fuel vehicle credits are 50% of incremental cost with an additional 30% available if vehicle meets rigorous emission standards. Maximum tax credits by weight class range from \$4,000 for up to 8,500 pounds to \$32,000 for more than 26,000 pounds.
- Excise and fuel use tax credits
 - Excise tax credit for non-taxable use
 - Biodiesel- 24.3 cents per gallon of biodiesel, E85- 18.4 cents per gallon, CNG & LPG- 18.3 cents per GGE, LNG- 24.3 cents per GGE
 - Fuel use credit
 - Biodiesel- 50 cents or \$1.00 per gallon of biodiesel depending on feedstock, E85- 51 cents per gallon, CNG, CNG & LPG- 50 cents per GGE

Proposals In Front of the 110th Congress

GHG Emissions

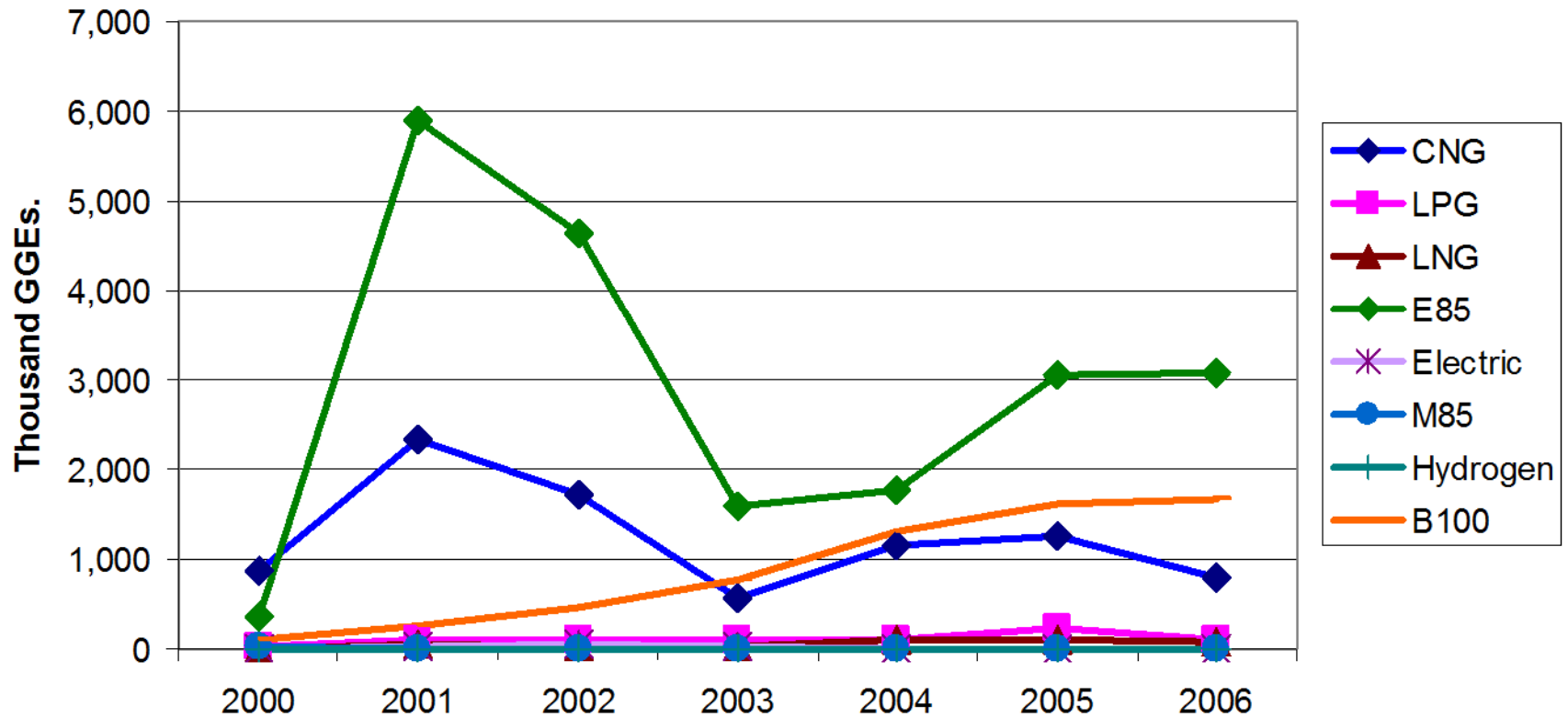
- H. Con. Res. 96: Concurrent resolution expressing the sense of the Congress that there should be enacted a mandatory national program to slow, stop and reverse GHG emissions.
- H.R. 620: Climate Stewardship Act
- H.R. 823: A bill to authorize Federal agencies and legislative branch offices to purchase GHG offsets
- S. 6: National Energy and Environmental Security Act
- S. 280: Climate Stewardship and Innovation Act of 2007
- S. 309: Global Warming Pollution Reduction Act
- S. 317: electric Utility Cap and Trade Act of 2007
- S. 485: Global Warming Reduction Act of 2007
- S. 1059: Zero-Emissions Building Act of 2007

Transportation Emissions

- H.R. 182: TEAM up for Energy Independence Act
- H.R. 370: Coal-to-Liquid Fuel Promotion Act
- H.R. 670: Dependence Reduction through Innovation in Vehicles and Energy (DRIVE) Act
- H.R. 1215: A bill to authorize the Secretary of Energy to make certain loan guarantees for advanced conservation projects
- H.R. 1300: Program for Real energy Security (PROGRESS) Act
- S. 133: American Fuels Act of 2007
- S. 339: Dependence Reduction through Innovation in Vehicles and Energy (DRIVE) Act
- S1073: Clean Fuels & Vehicles Act of 2007

Federal Alternative Fuel Consumption

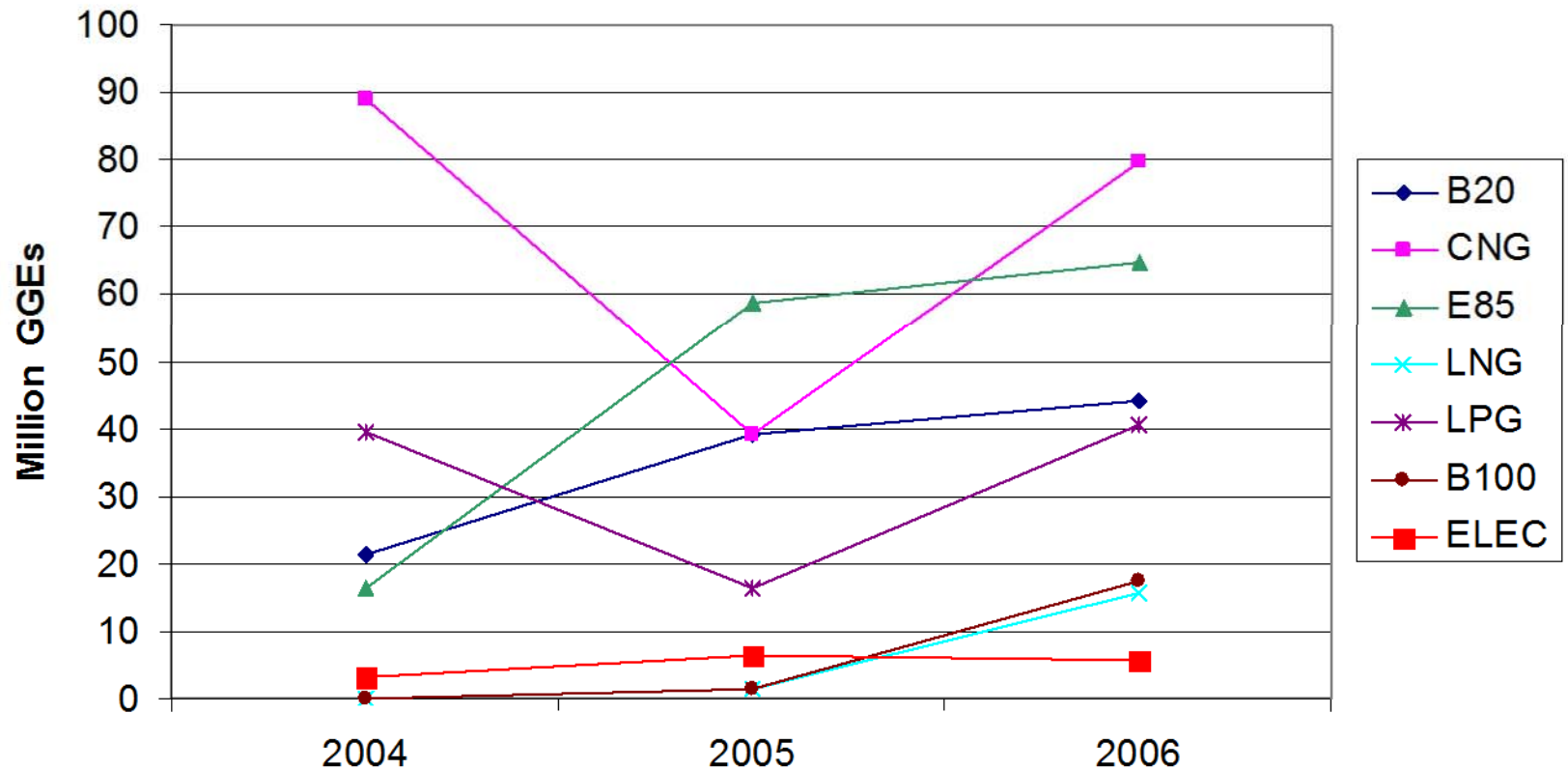
Federal Alternative Fuel Consumption by Fuel Type



Source: Federal Automotive Statistical Tool (FAST)

GGE Displacement

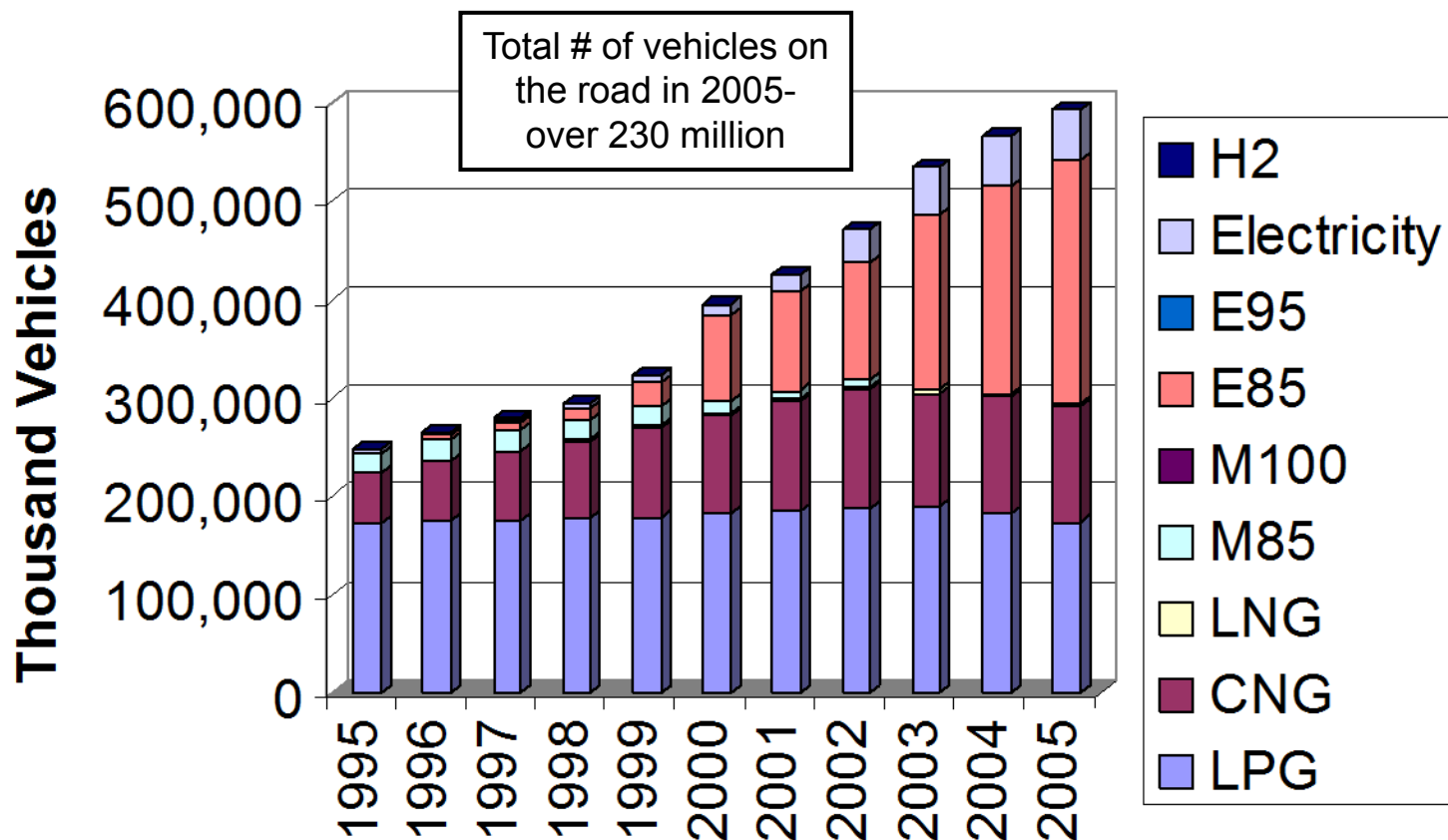
Clean Cities Petroleum Displacement by AFV Type



Source: Clean Cities Coordinator Annual Reports, 2004-2006

Vehicles

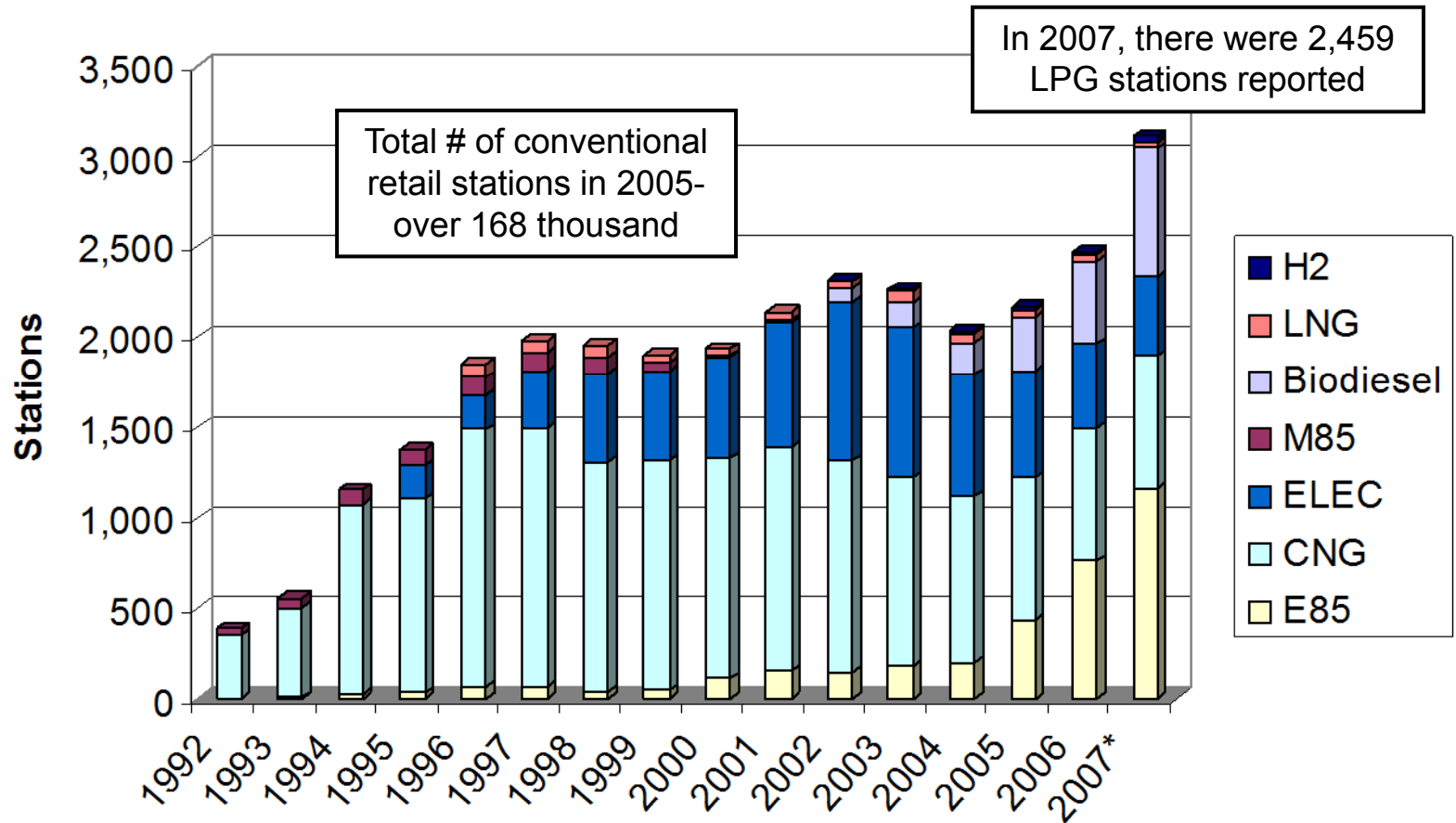
Alternative Fueled Vehicles in Use



Source: EIA's Annual Energy Review, Table 10.4. Available at www.eia.doe.gov/emeu/aer/renew.html

Station Counts

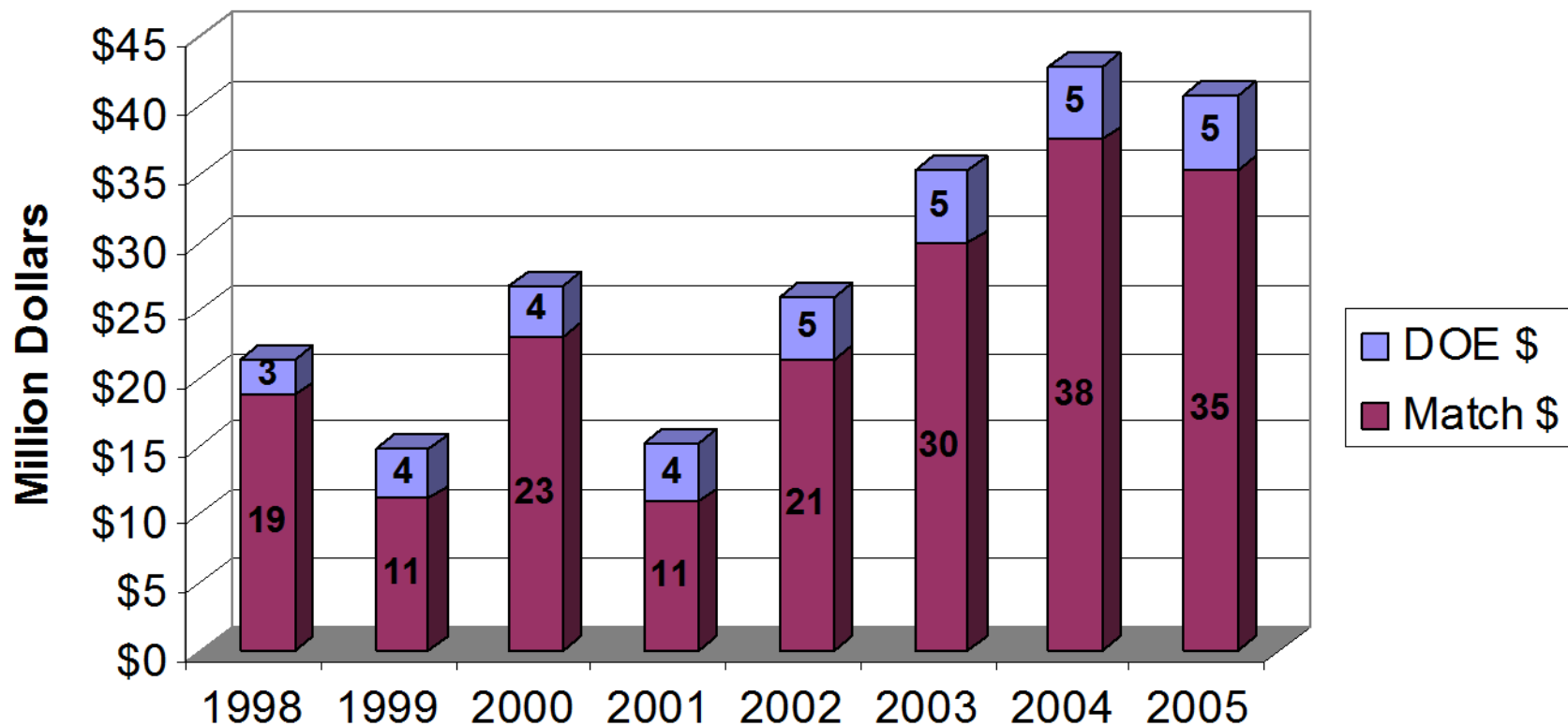
U.S. Alternative Fueling Station Count



Source: Alternative Fuels Data Center (AFDC), either directly or from historical Transportation Energy Data Books (www.osti.gov/bridge/basicsearch.jsp)

Grants

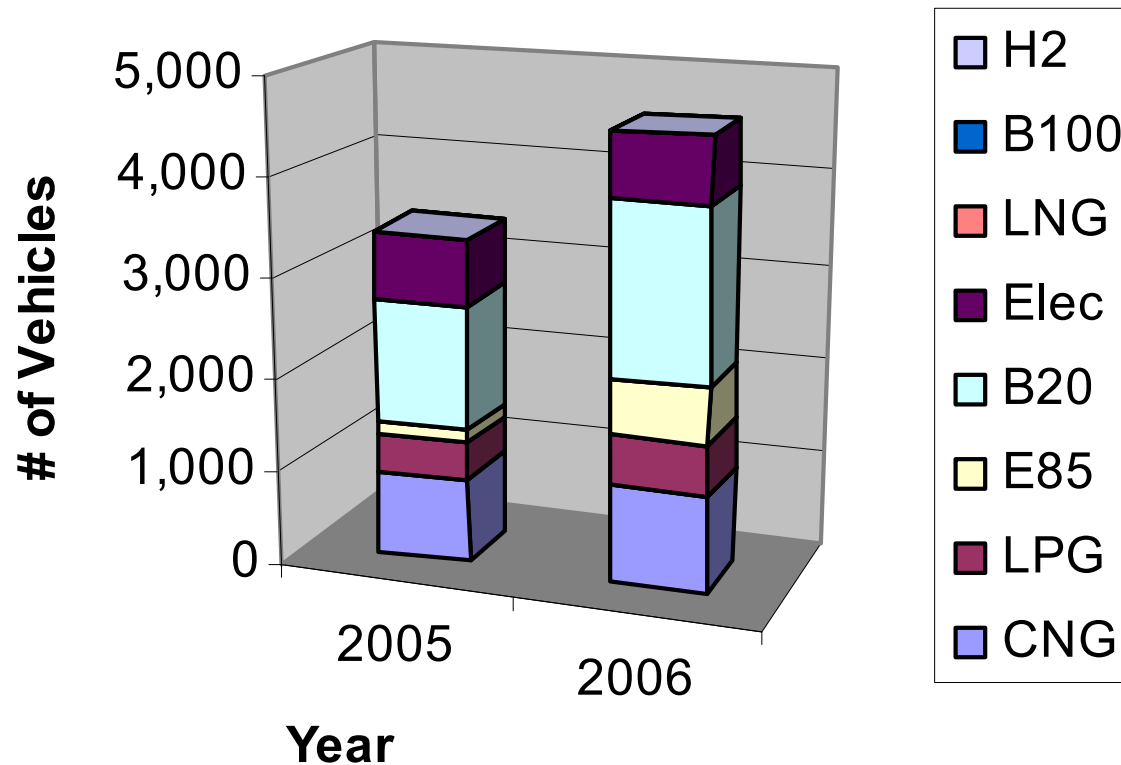
Grants for Clean Cities Projects



Source: Clean Cities program office

Tucson Clean Cities Alternative Fuel Vehicles

Tucson Clean Cities Alternative Fuel Vehicles



Source: Clean Cities Coordinator Survey, 2006

These AFV's displaced over 4.2 million GGE's

Some Sensible Solutions

- Reduce VMT
 - Mass transit, carpool, bike, walk, telecommute
- Replace Fuels
 - Biofuels
 - Clean diesel
 - Hydrogen
 - Electricity
- Reduce Vehicle Fuel Consumption
 - All vehicles
 - Reduce mass, aerodynamic drag, rolling resistance
 - Conventional vehicles
 - Cylinder deactivation, 6-speed transmissions
 - Advanced powertrains
 - Hybrid-electric vehicles **Could reduce fuel by 30%**
 - Plug-in HEVs **Could reduce fuel by 60%**
 - Fuel cell vehicles

Avoid the Fuel Economy Trap

What's better to do? (12,000 miles/yr)

16 mpg to 20 mpg
(4 mpg gain, 25% incr.)



50 mpg to 100 mpg
(50 mpg gain, 100% incr.)



Avoid the Fuel Economy Trap

What's better to do? (12,000 miles/yr)

16 mpg to 20 mpg
(4 mpg gain, 25% incr.)



Fuel Consumption

750 gal to 600 gal
150 gal saved, 20%

50 mpg to 100 mpg
(50 mpg gain, 100% incr.)

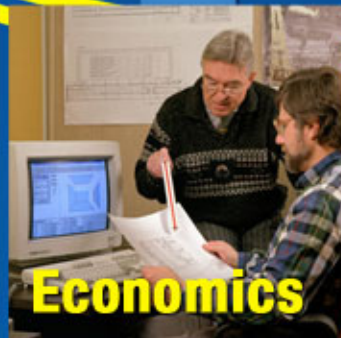
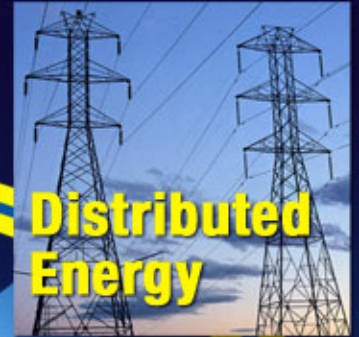
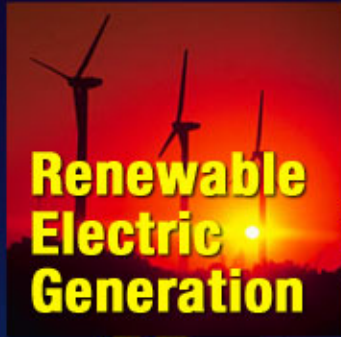


Fuel Consumption

240 gal to 120 gal
120 gal saved, 50%

Better yet – go from 16 mpg to 50 mpg & save 510 gal/yr

Renewable Community



Conclusions

- Our country requires a reliable transportation system
 - Our current transportation system is inflexible, depending on one fuel from increasingly limited sources in politically unstable regions
- Oil
 - Production is flat or declining
 - Demand is increasing (domestically and globally)
 - Reserves are diminishing and are in politically unstable areas
- Oil infrastructure is vulnerable
 - Natural disasters, equipment failures, terrorism/war, politics
- Multiple solutions are available and required
 - Fewer VMT
 - More efficient vehicles
 - Diverse sources of fuel, including electricity, biodiesel, ethanol
- Multiple sources of funding are available

This is a national issue requiring national and state level attention