

The Petroleum Problem

The Perfect Fuel

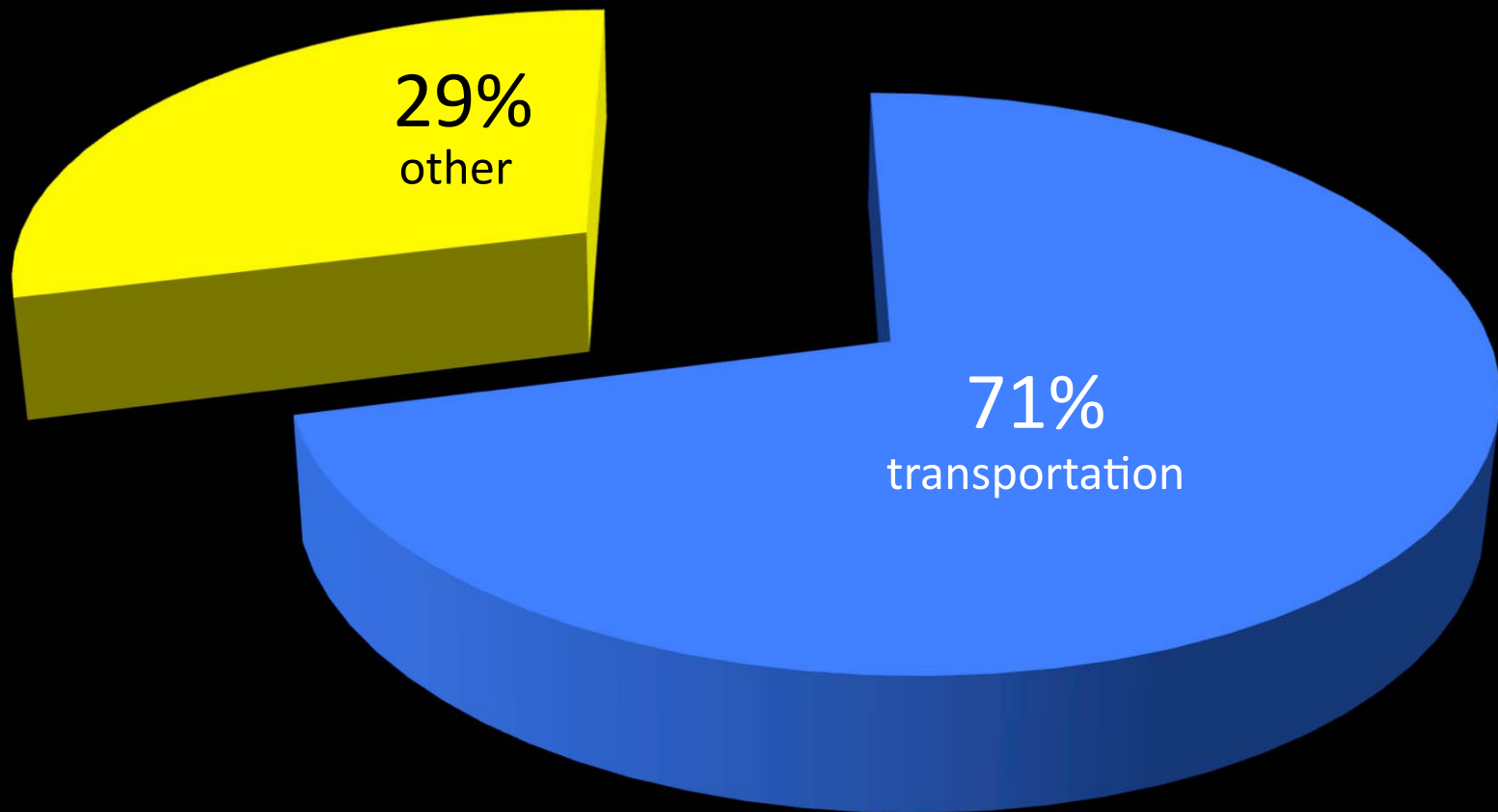
- Abundant
- Inexpensive
- Transportable



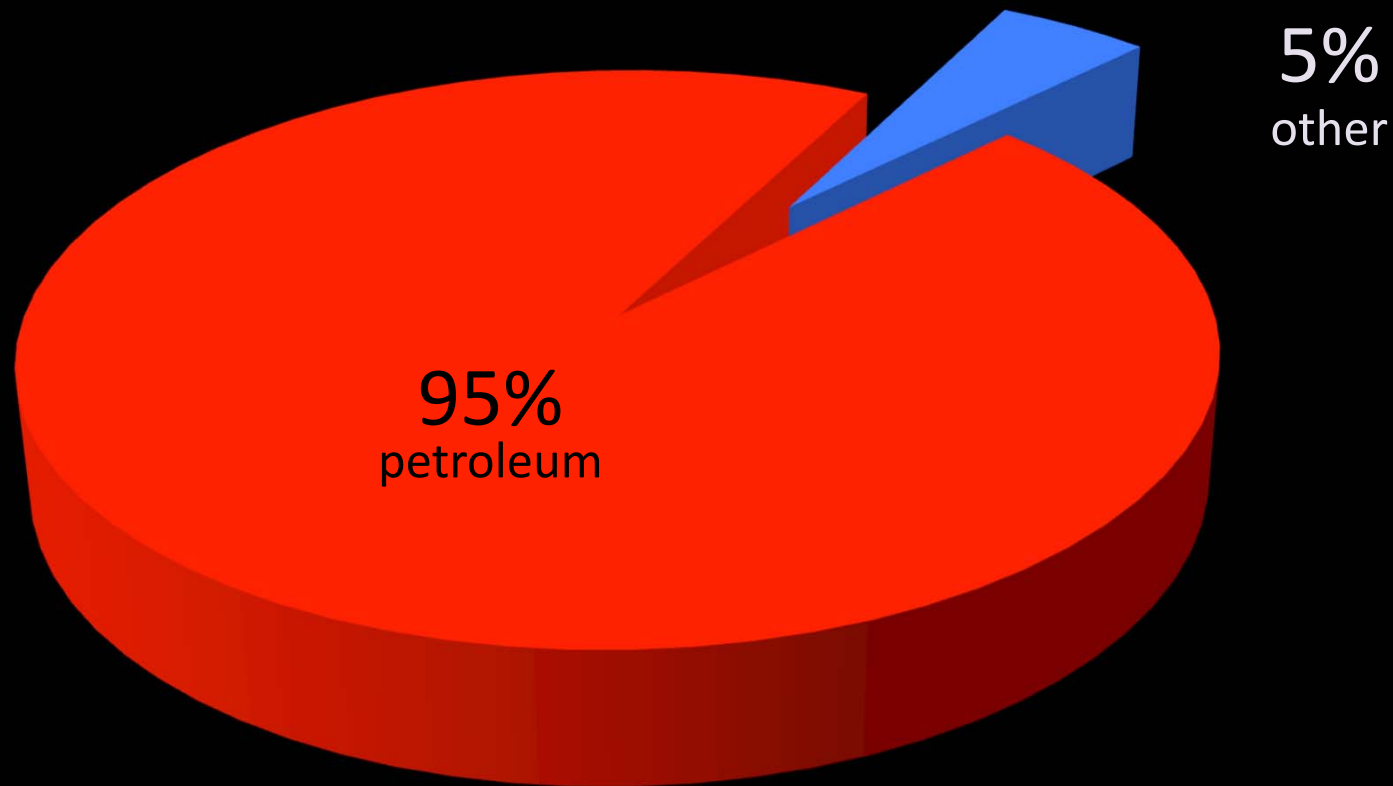
1

How We Use Petroleum

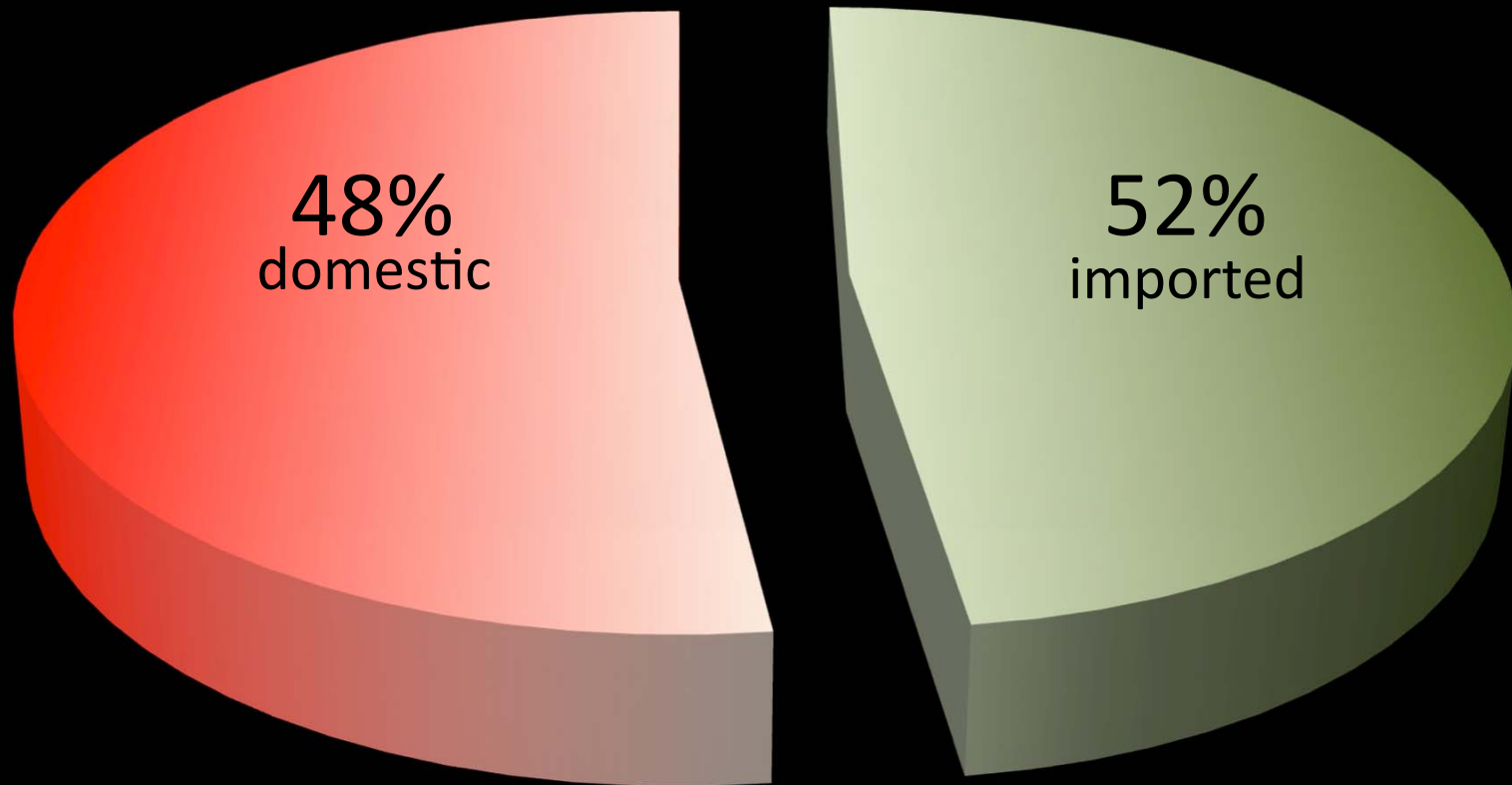
US Petroleum Consumption by End Use Sector – 2009



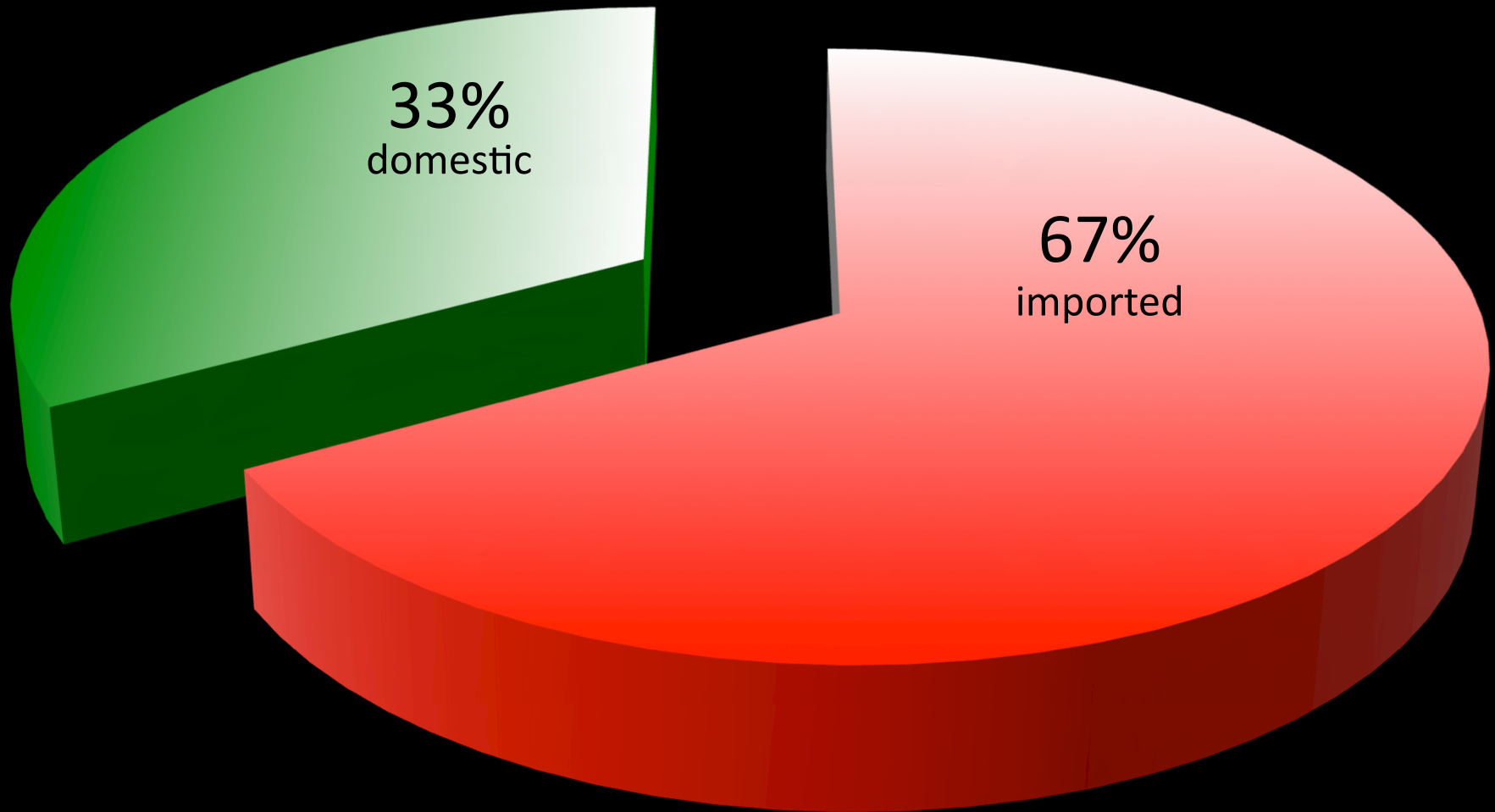
US Transportation Energy Consumption – 2009



Net Petroleum Imports – 2009



Source of Transportation Petroleum, 2009



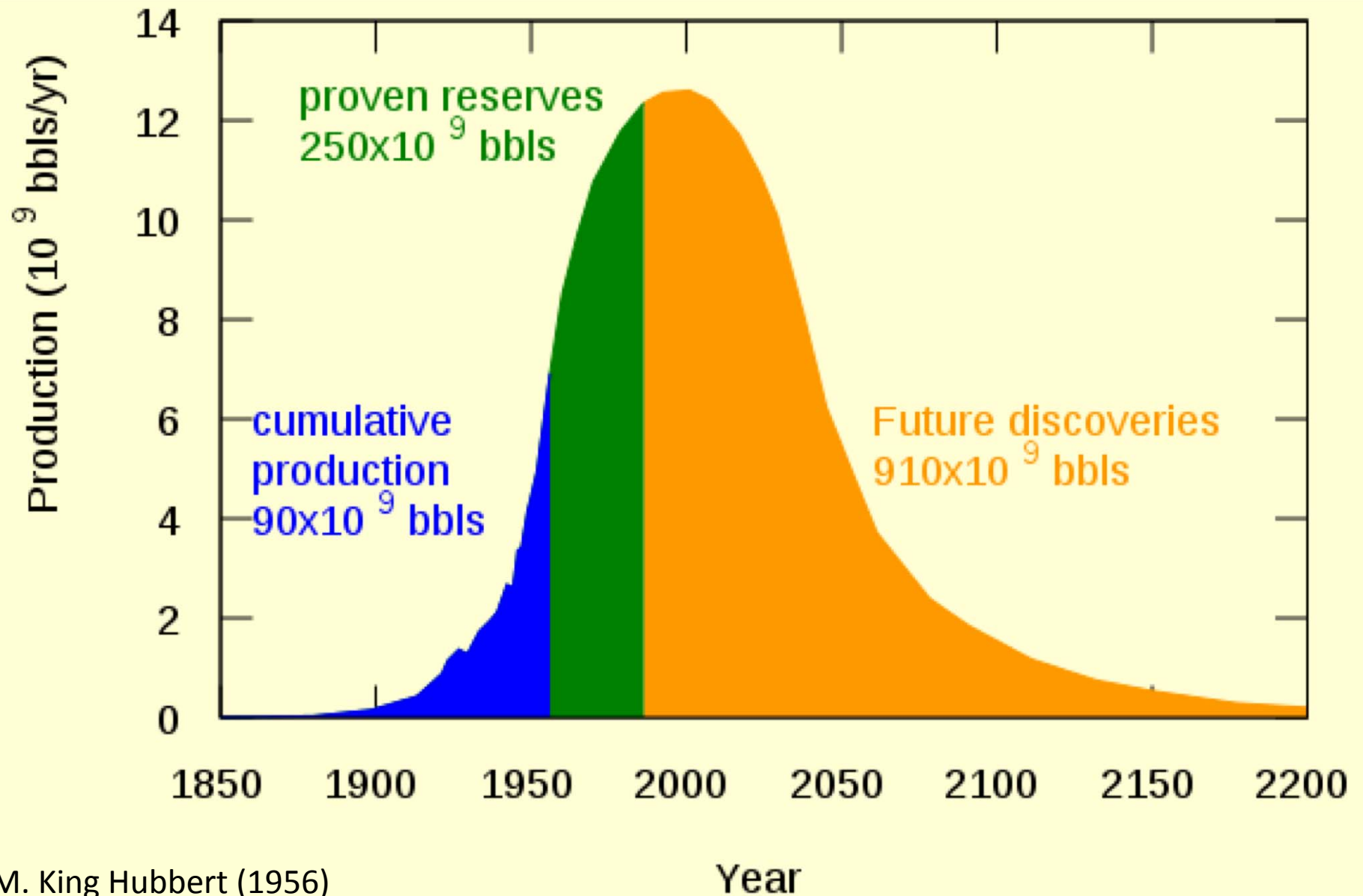
Our transportation systems are
dependent on petroleum


imported

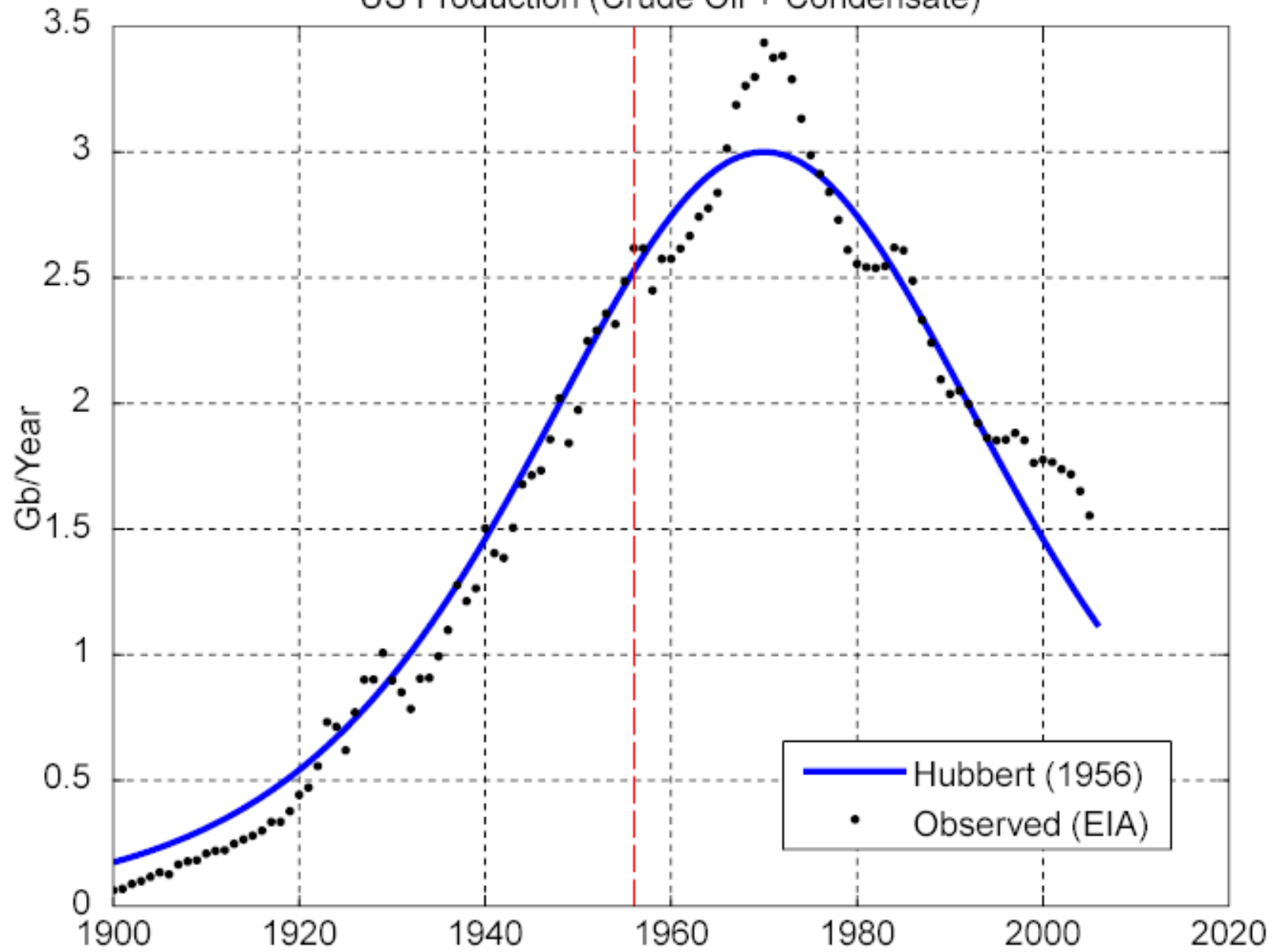
2

“Peak Oil”

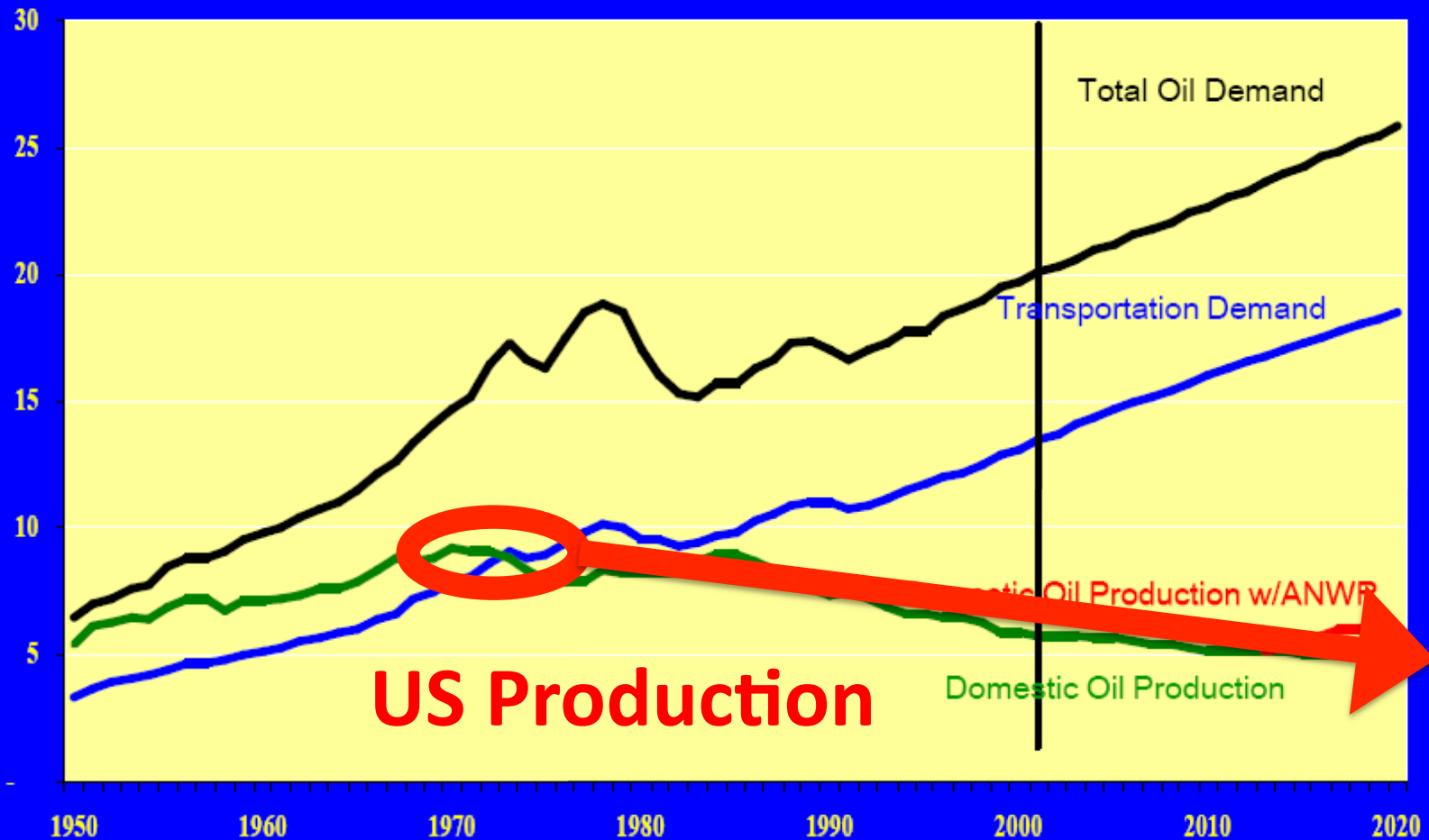
The Original Hubbert Curve



US Production (Crude Oil + Condensate)



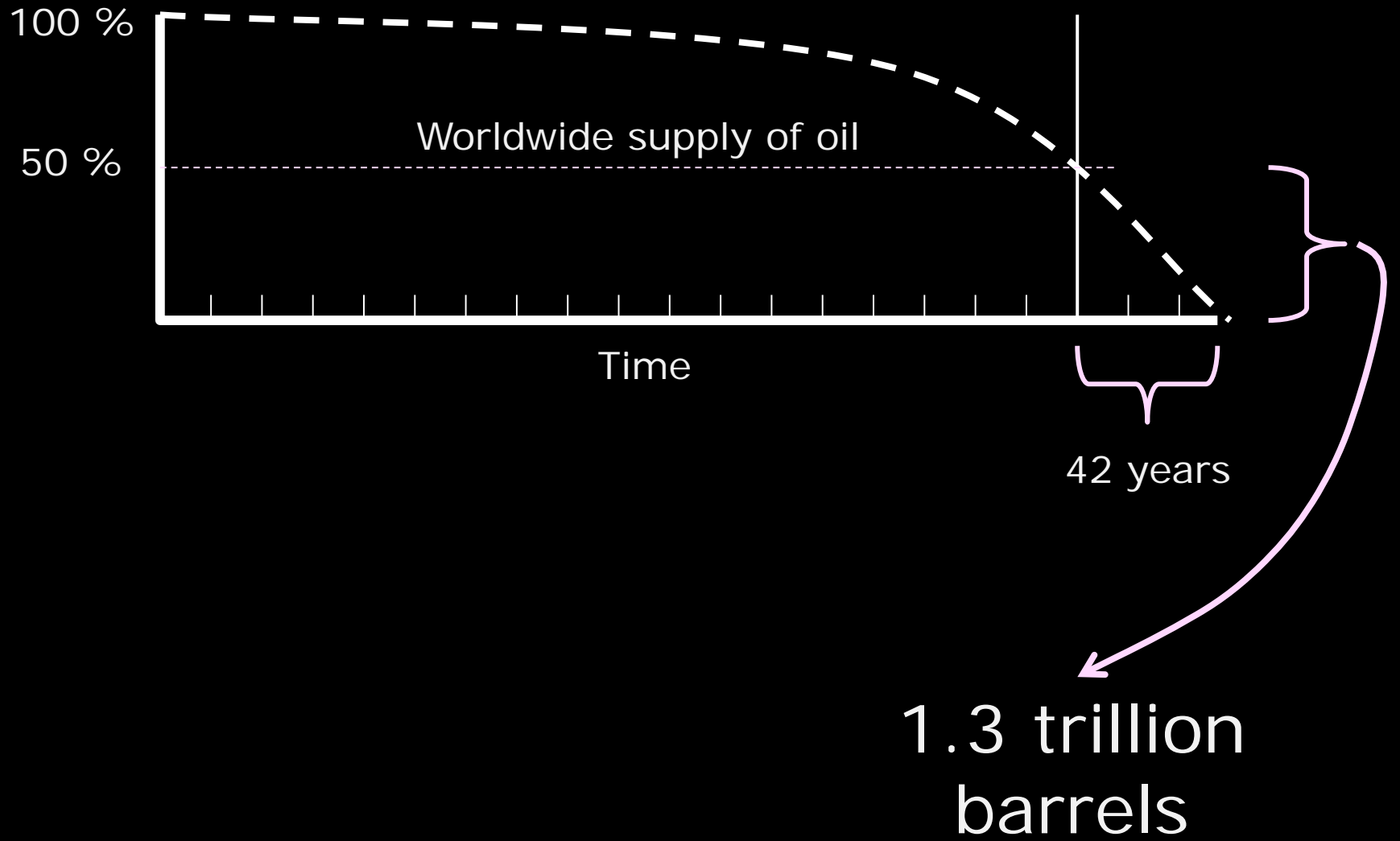
US Oil Consumption (million barrels per day)

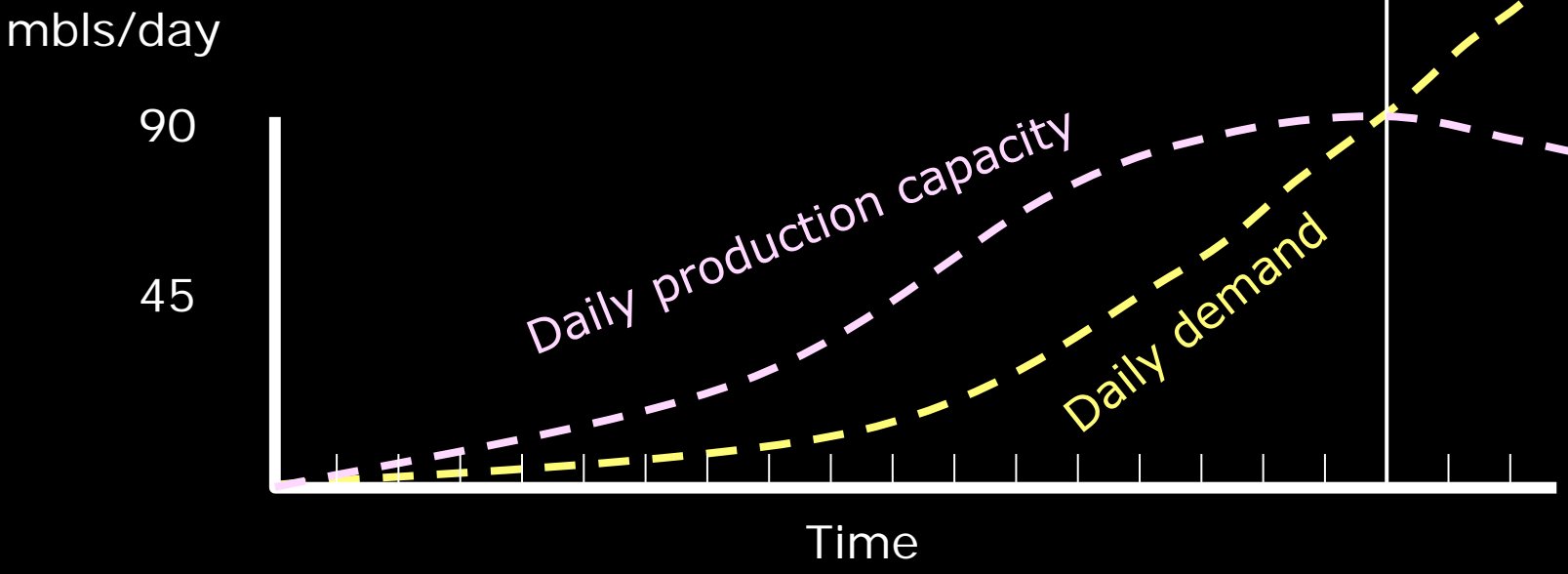
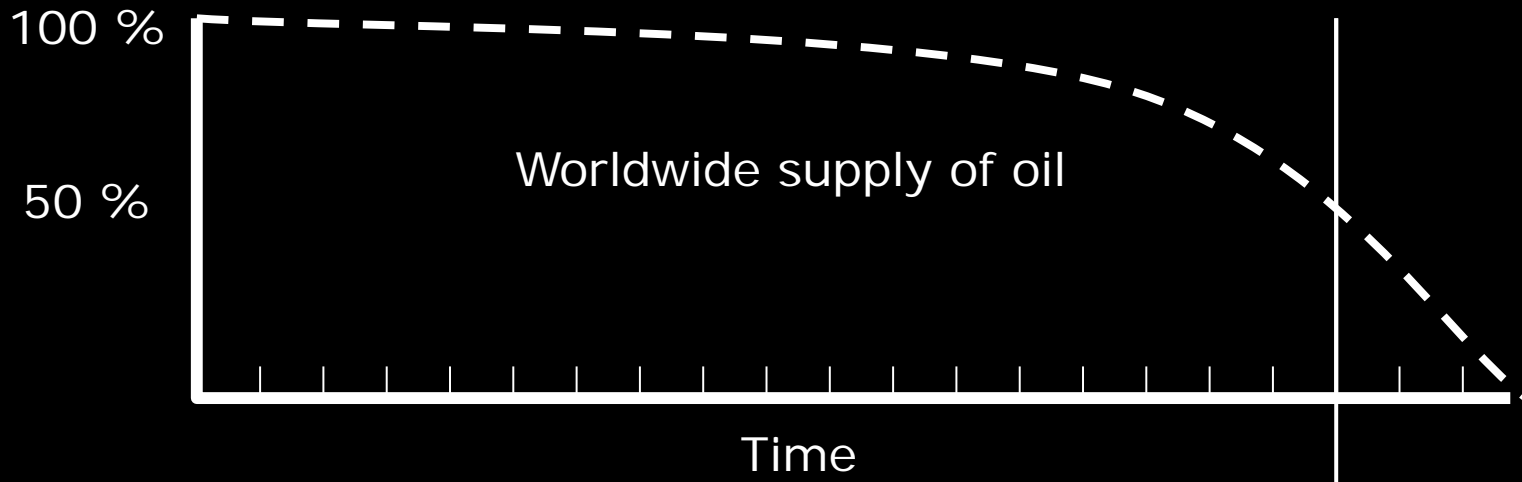


EIA, Annual Energy Outlook 2001; "Potential Oil Production from the Coastal Plain of ANWR," - EIA Reserves & Production Division

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Cost of Petroleum





mbbl/day

\$ 900

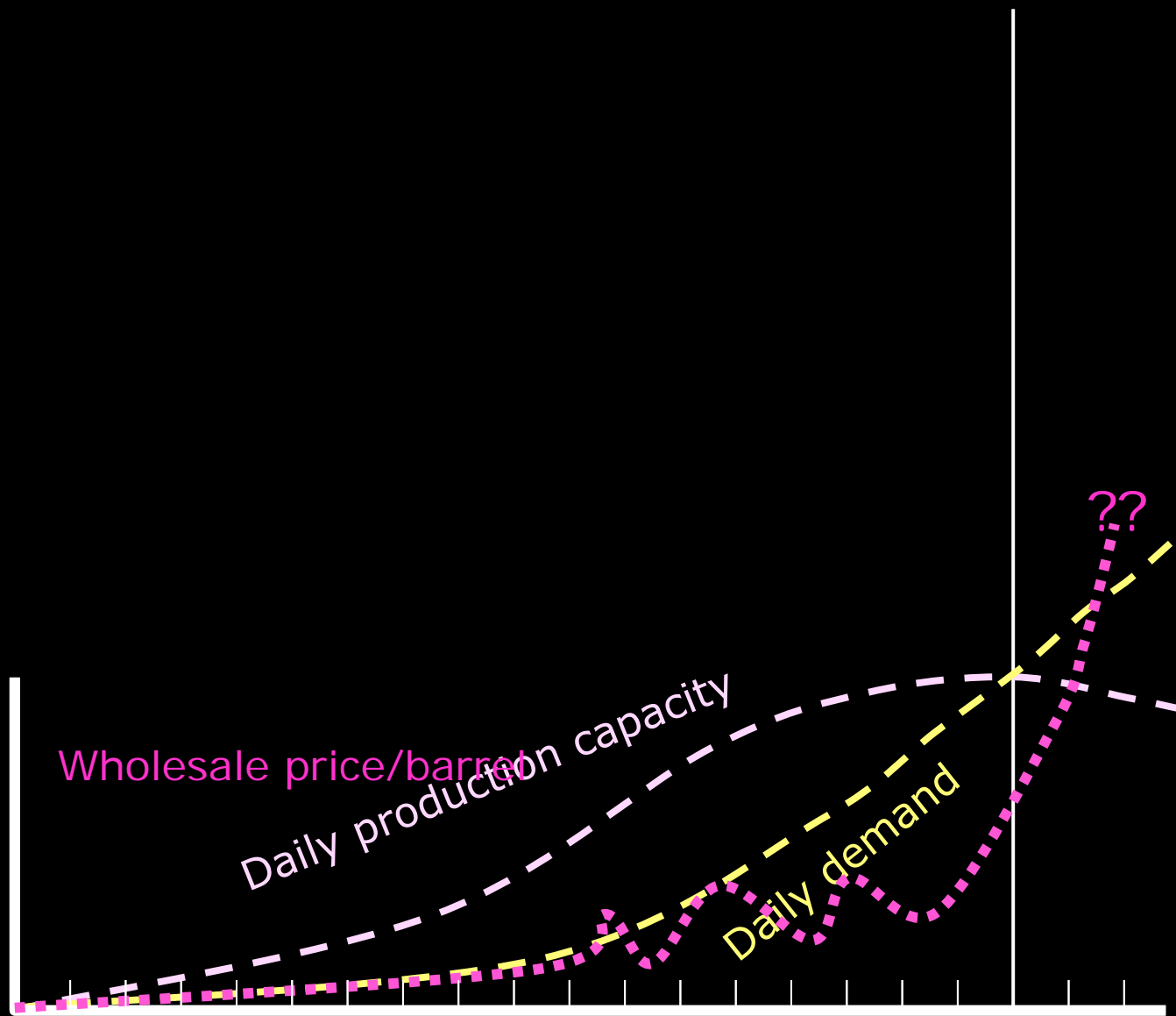
\$ 450

Wholesale price/barrel
Daily production capacity

Daily demand

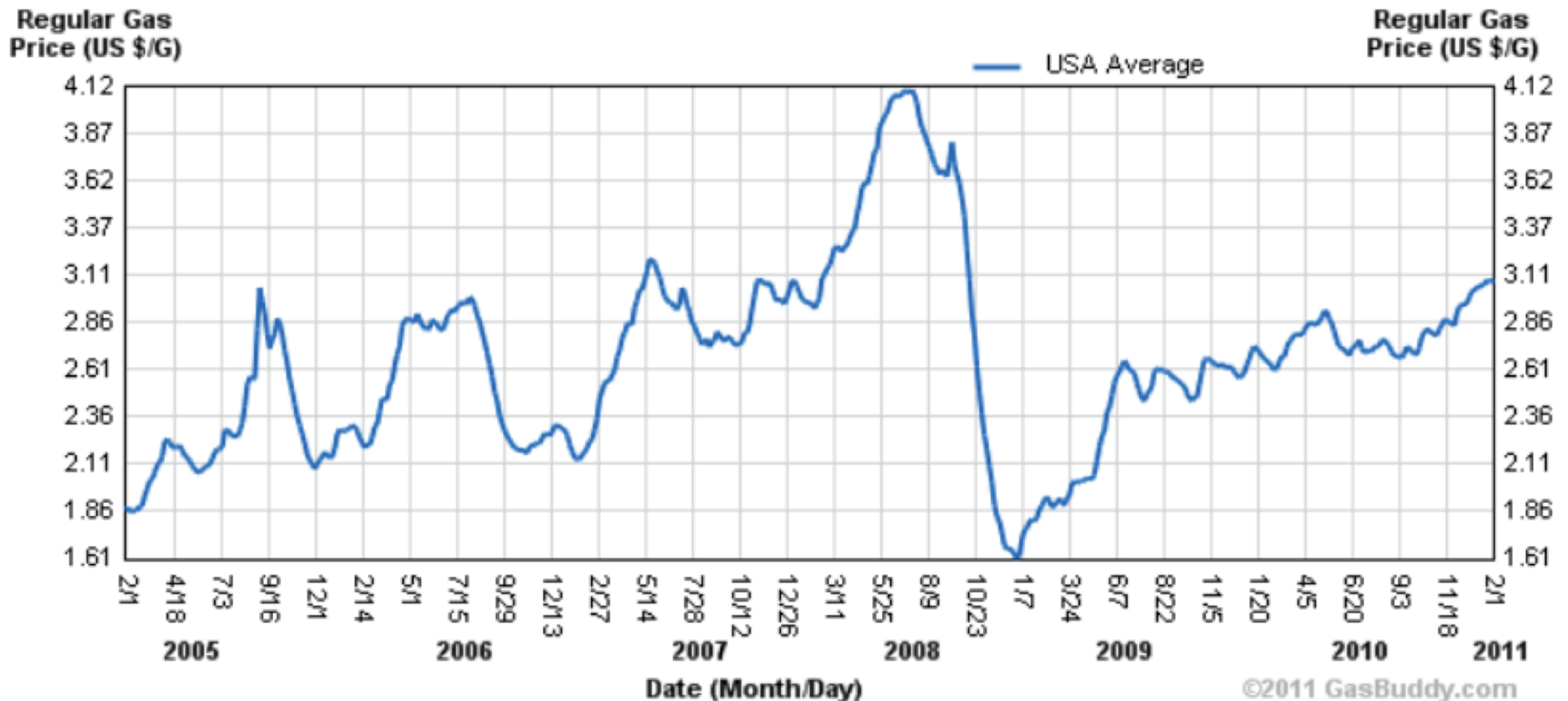
Time

??

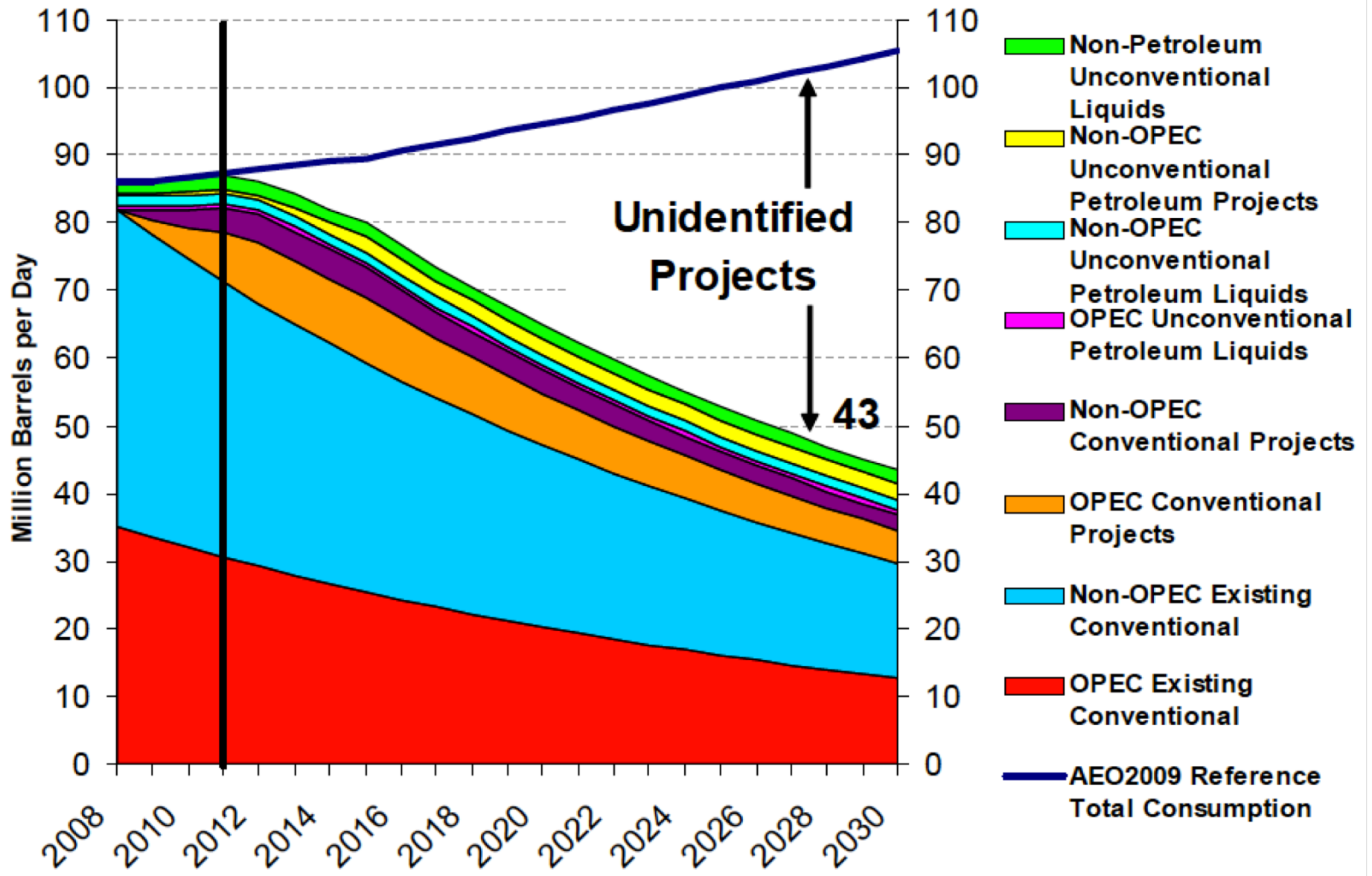


As Demand Exceeds Supply: Volatile Gas Prices

72 Month Average Retail Price Chart



World's Liquid Fuels Supply

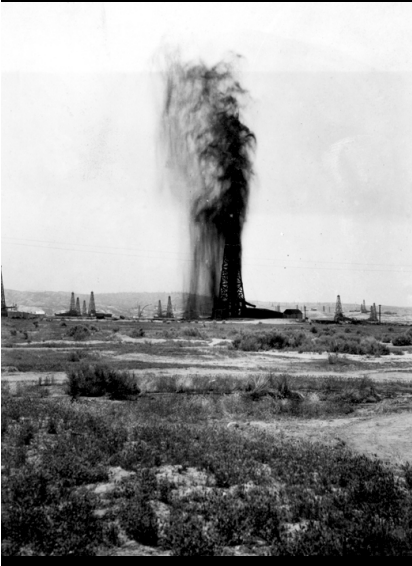


Source: EIA, AEO2009

This is not a supply issue...

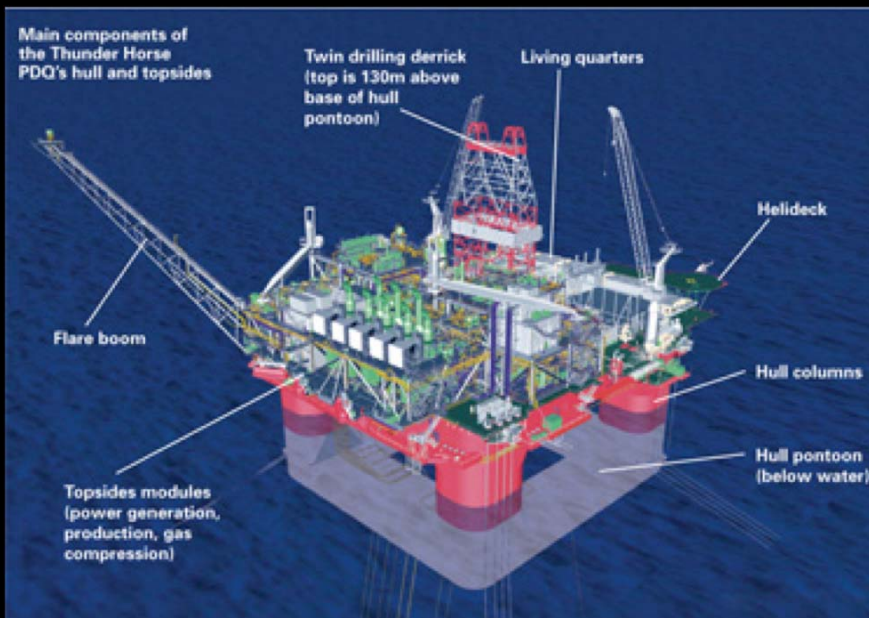
...it is an economic issue.

Those were
the days!





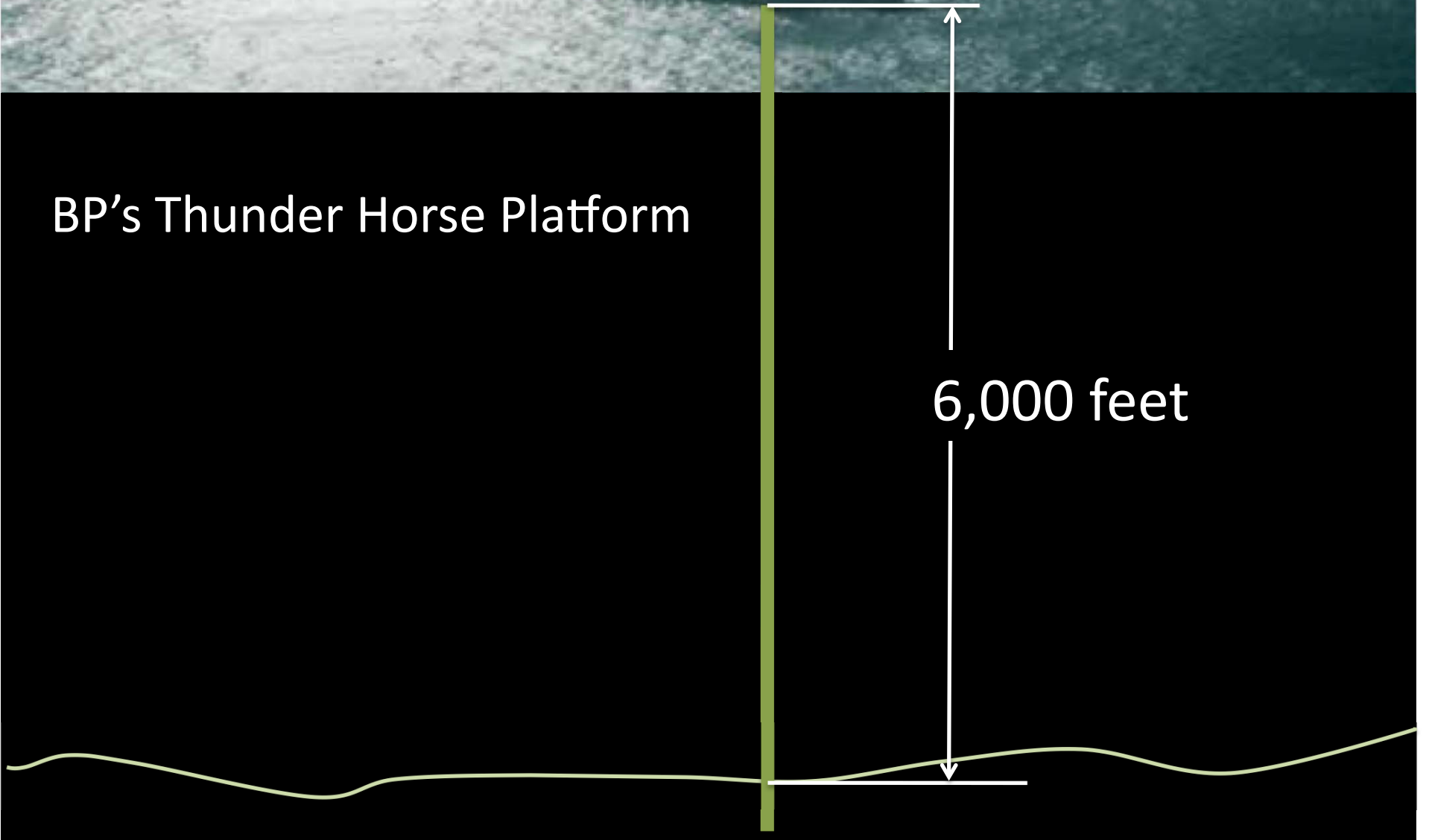
BP's Thunder Horse Field Production Facility Cost: \$1 billion

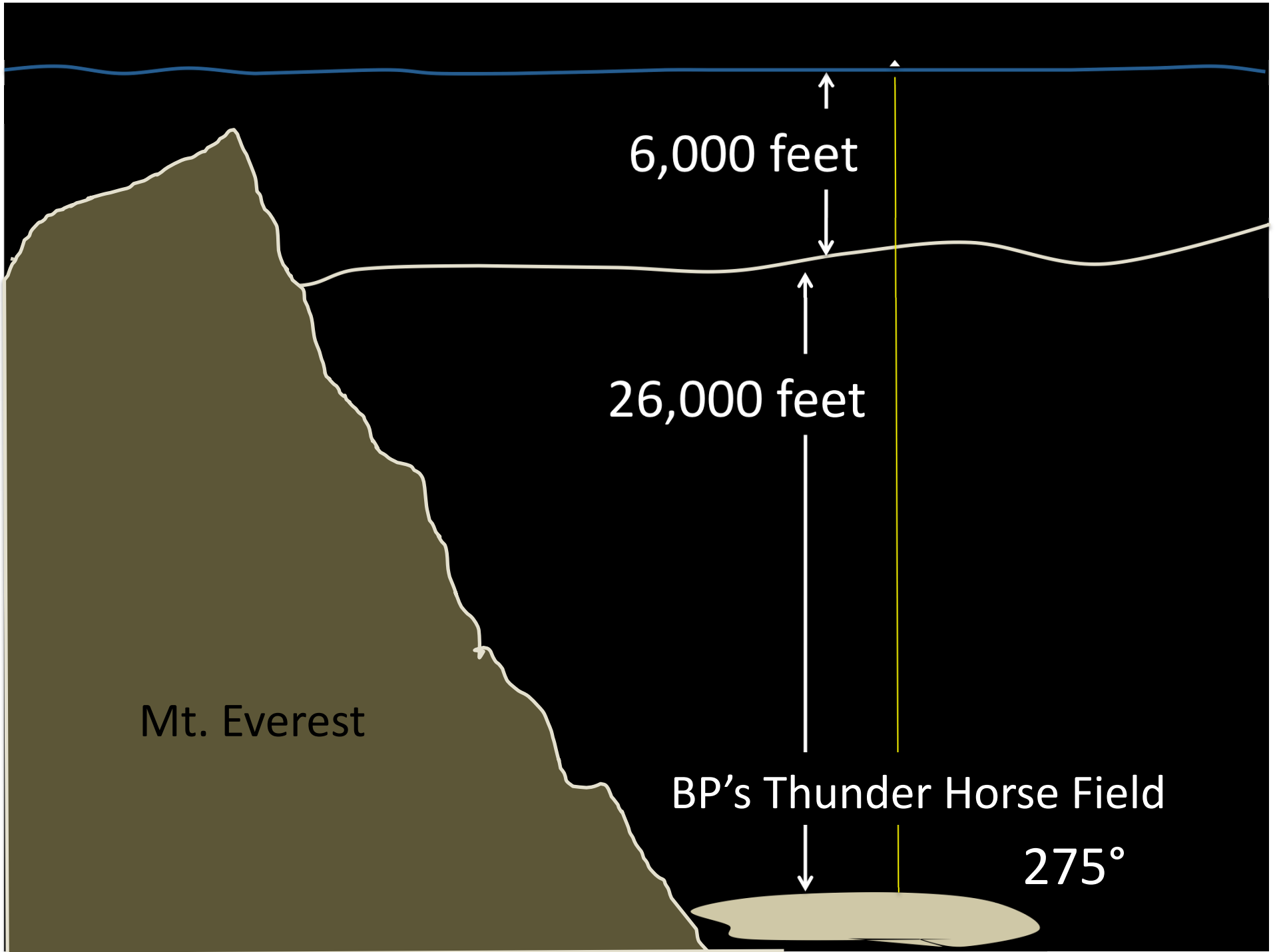




BP's Thunder Horse Platform

6,000 feet



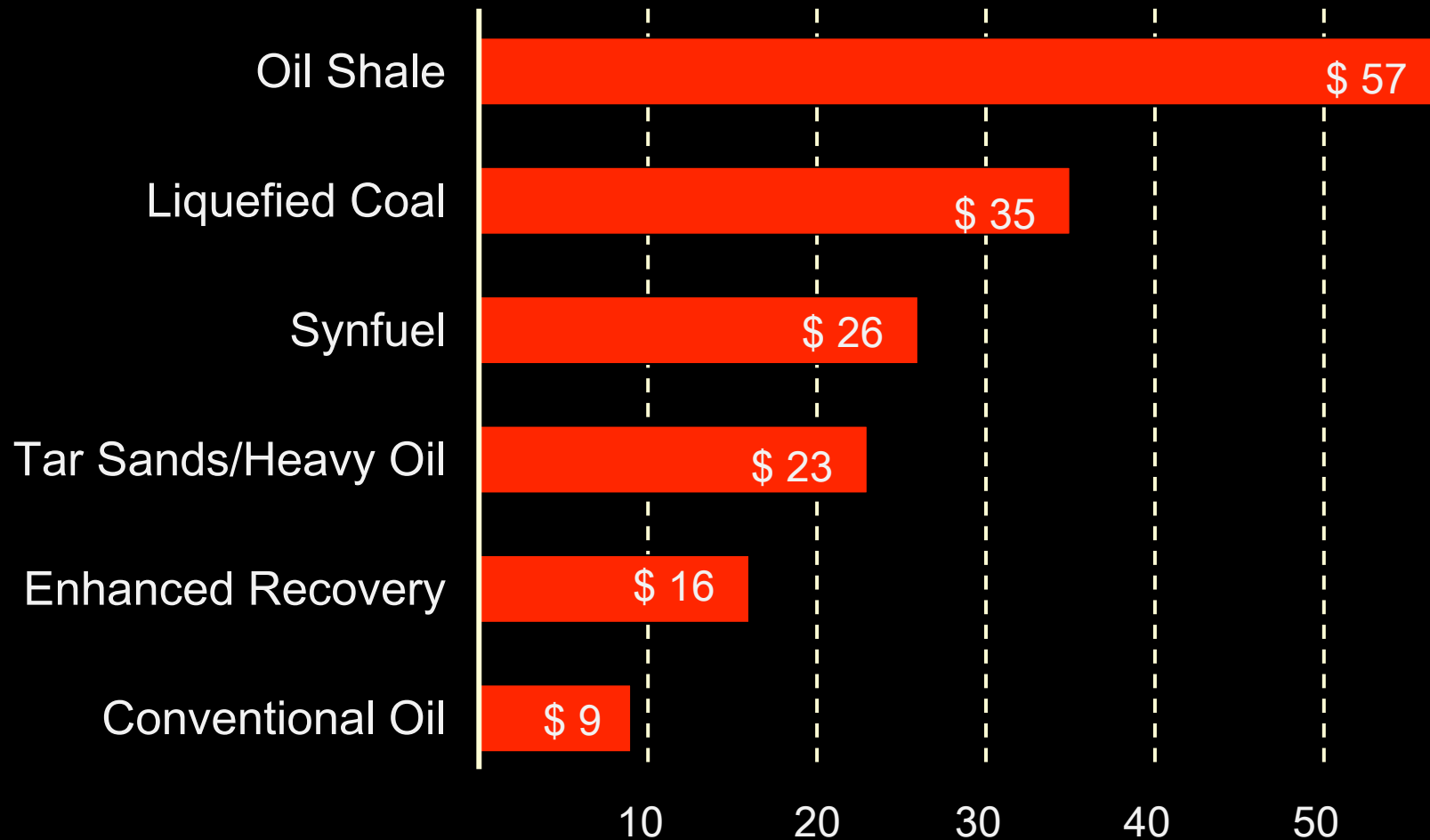


Cost of Crude Oil to Refineries



Production Cost – Sources of Oil

Production Cost Per Barrel of Oil - 2007



Source: Brandt & Farrell, UC Berkeley

Alberta Tar Sands

Carbon Pollution:
Tar Sands = 3x carbon pollution
per barrel of conventional crude*

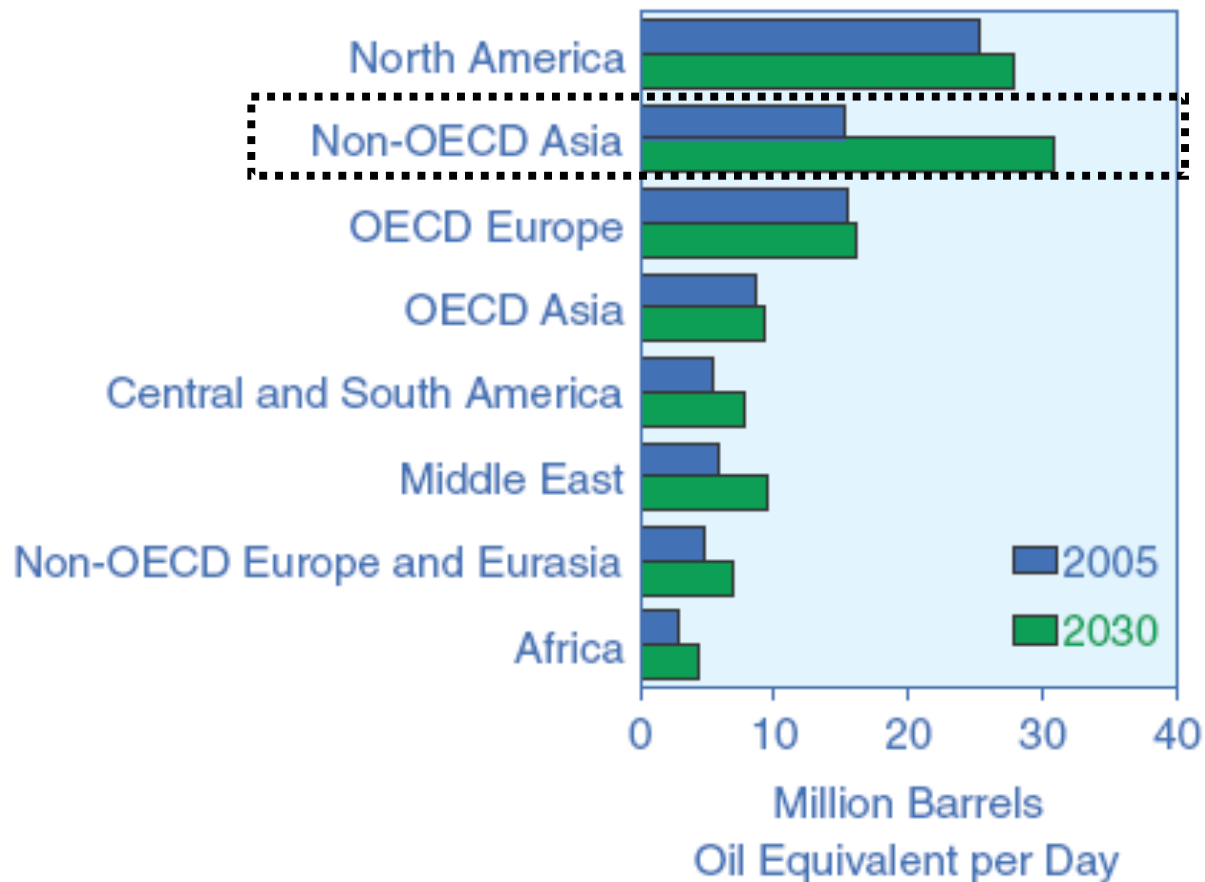
*Source: NRDC

The
oil
is not gone

The
cheap oil
is gone

Petroleum Demand by World Region

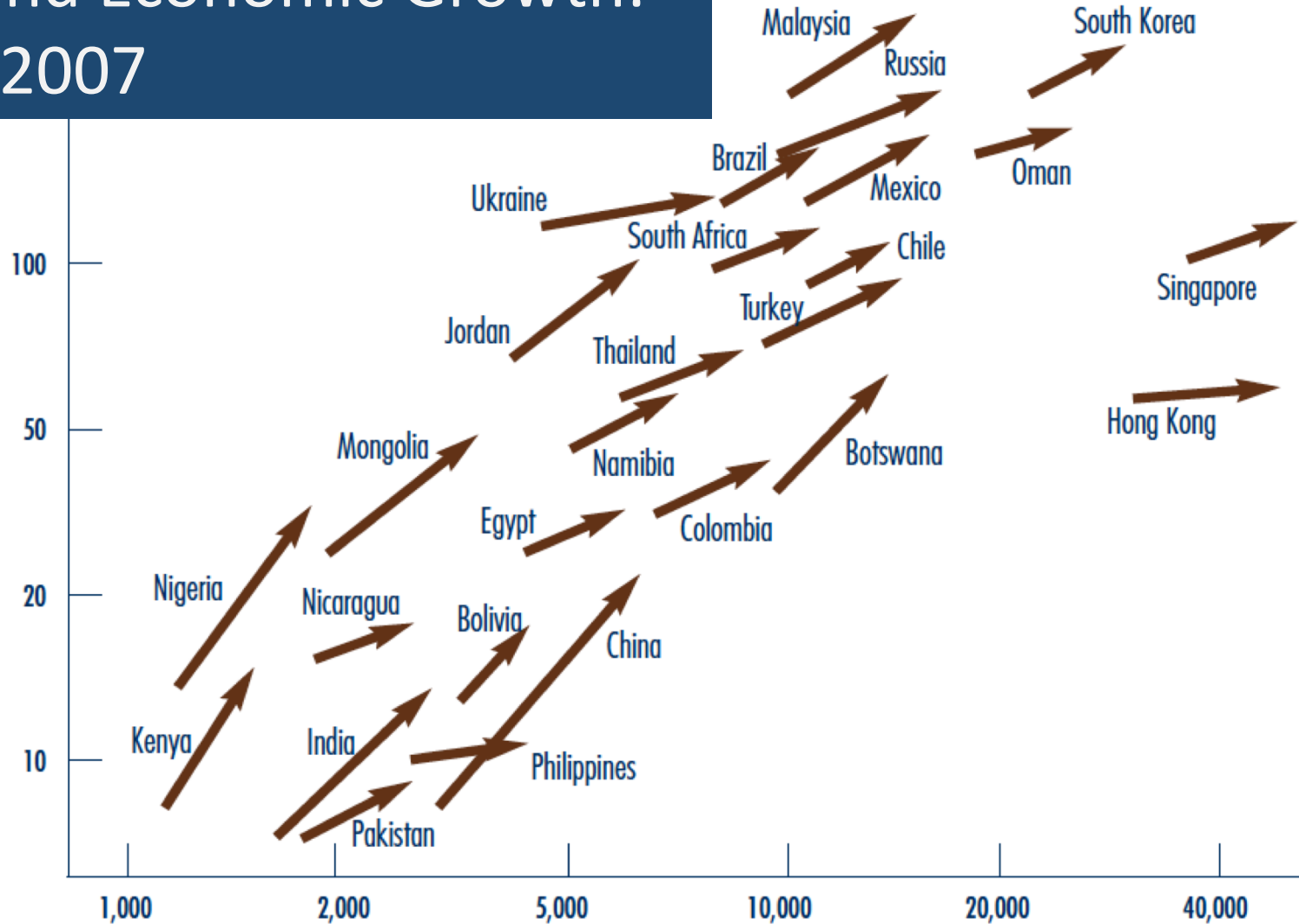
Figure 29. World Liquids Consumption by Region and Country Group, 2005 and 2030



India & China
will double
their demand
for petroleum
by 2030

Autos and Economic Growth: 2002 – 2007

PASSENGER CARS PER 1,000 PEOPLE



INCOME PER-CAPITA (PURCHASING-POWER ADJUSTED US DOLLARS)

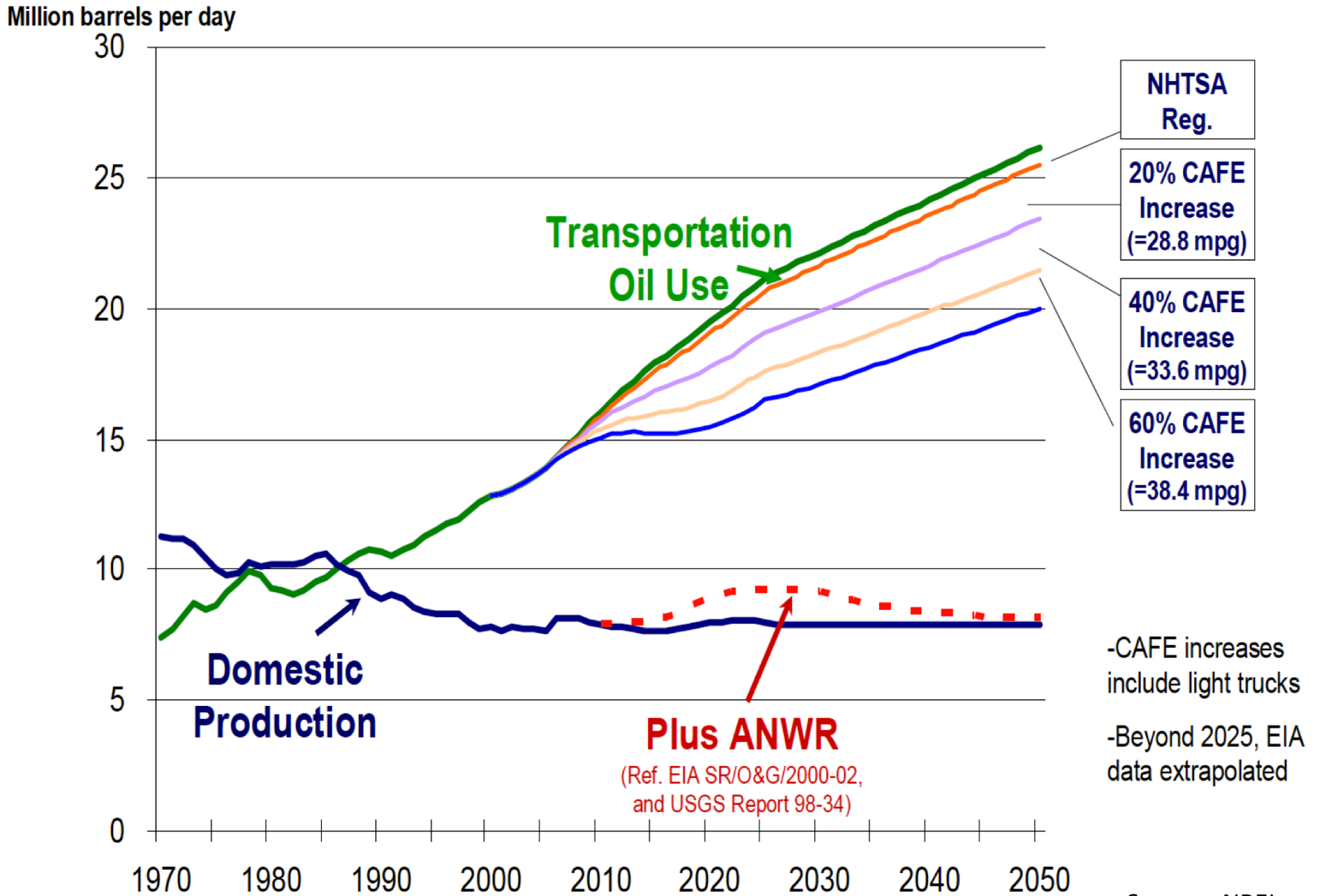
ACCESS

No 37, Fall 2010

“We’ll become more efficient.”

“We’ll use alternative fuels.”

Potential Reduction in Petroleum Consumption Through Technology



-CAFE increases include light trucks
 -Beyond 2025, EIA data extrapolated

Plus ANWR
 (Ref. EIA SR/O&G/2000-02,
 and USGS Report 98-34)



Total Motor Vehicles in Service in US in 2010	250,000,000
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Total Electric Autos in Service by End of 2012	100,000
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0.04%

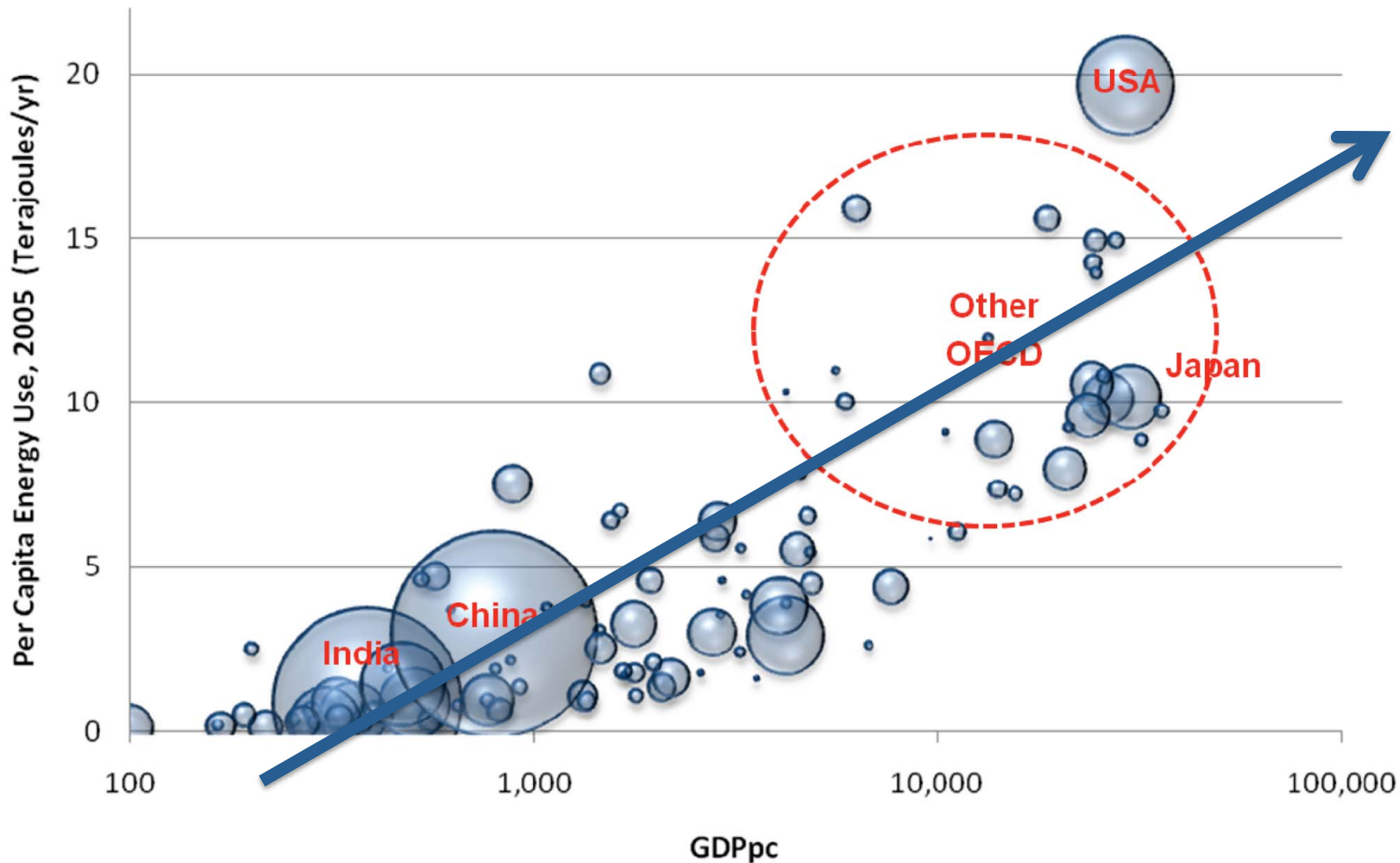
Technology will not save the day...

...for a couple of decades.

4

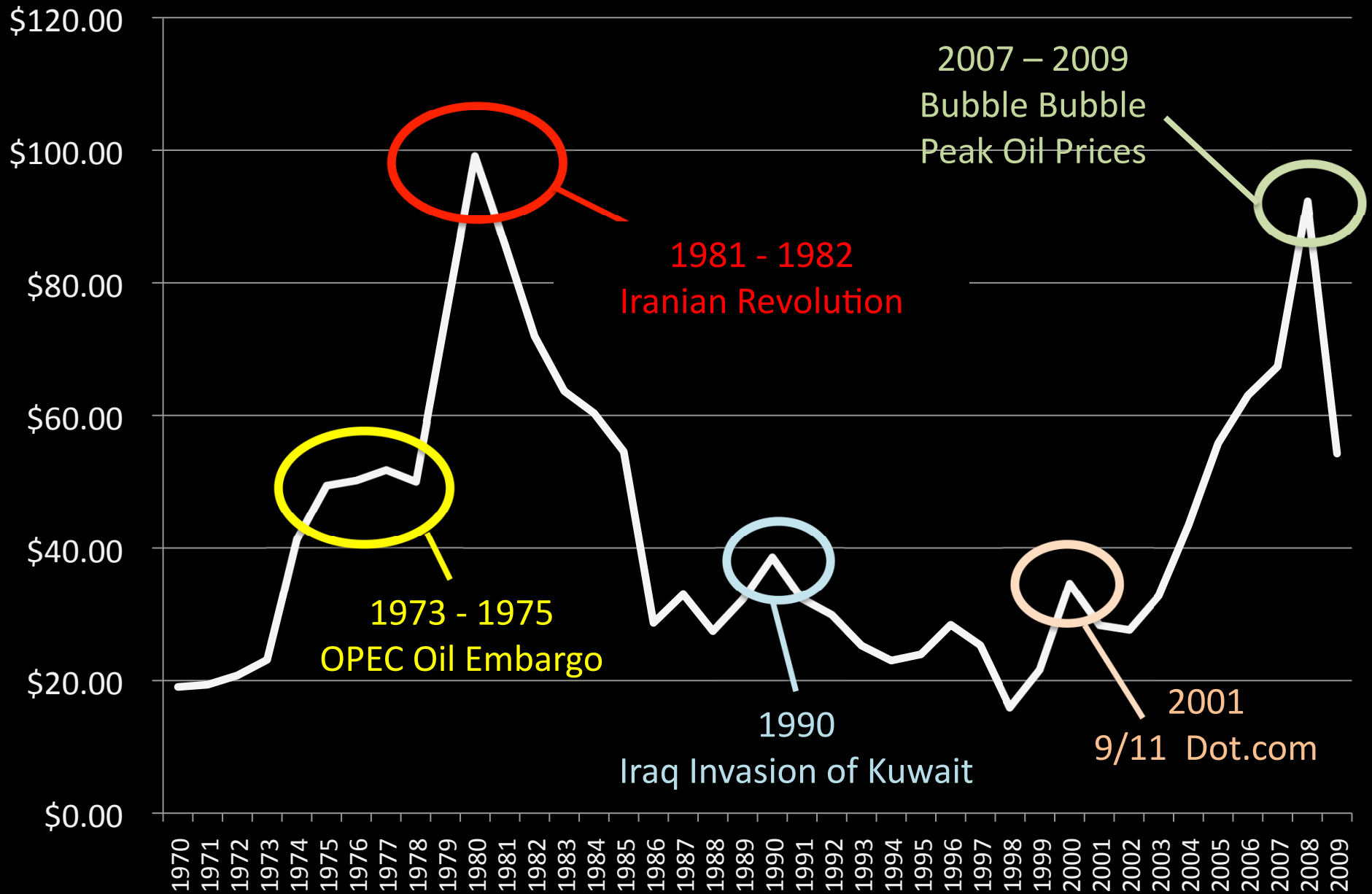
Petroleum and the US Economy

Figure 3: Energy and Income, by Country, Income, and Population (2005)

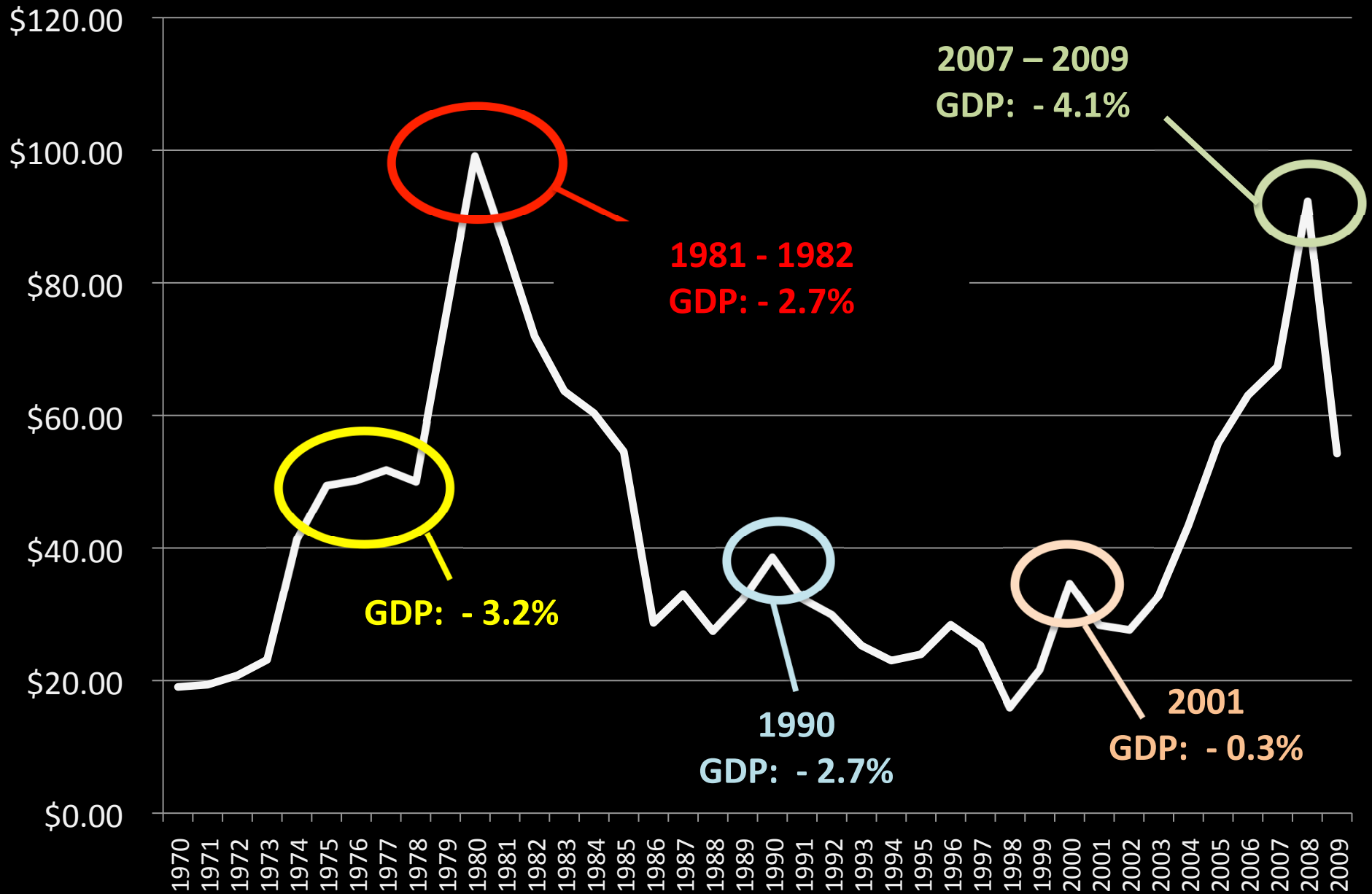


Source: Energy Pathways for the California Economy, UC Berkeley, June 2009

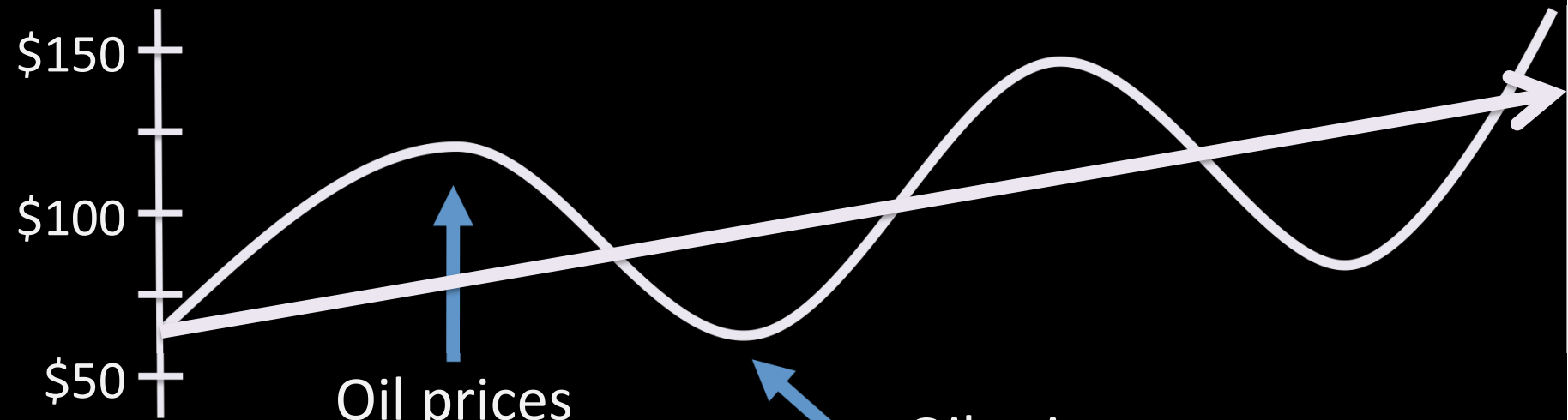
Inflation-Adjusted Crude Oil Prices



Inflation-Adjusted Crude Oil Prices

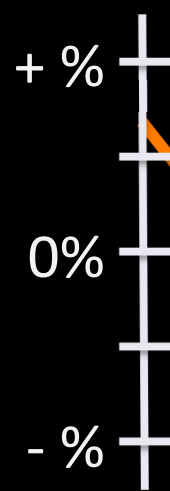


Oil price per barrel



Oil prices rise,
economy slows down

Oil prices drop,
economy rebounds

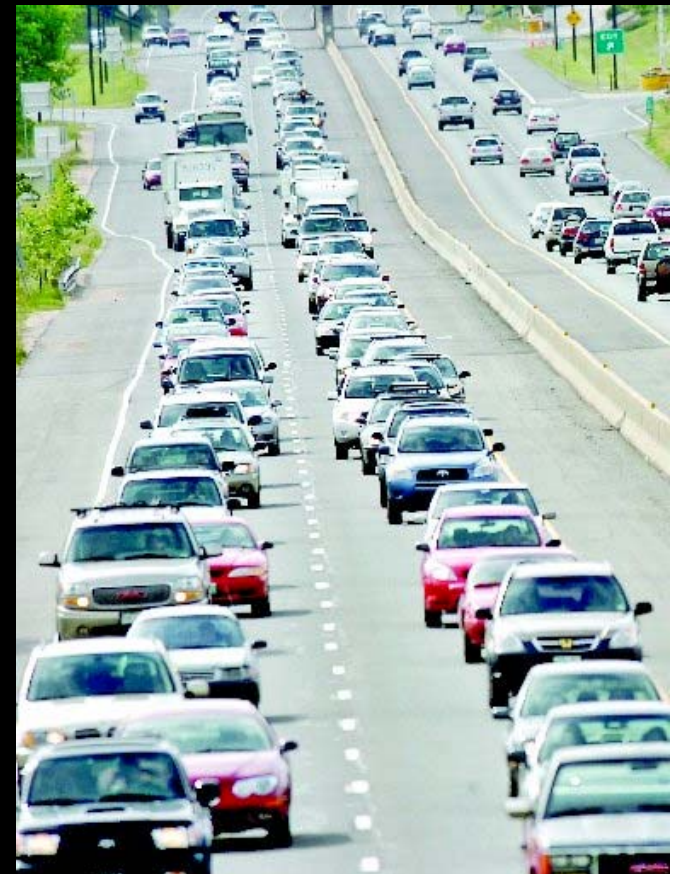


Rate of economic growth

Yesterday

Crude Oil* \$ 89 / barrel

Gasoline \$3.12 / gallon



* WTI Crude Spot Market

World's Two Largest Companies

\$328 b

\$315 b

PetroChina

Exxon Mobile

Based on market
capitalization on
3/23/10

5

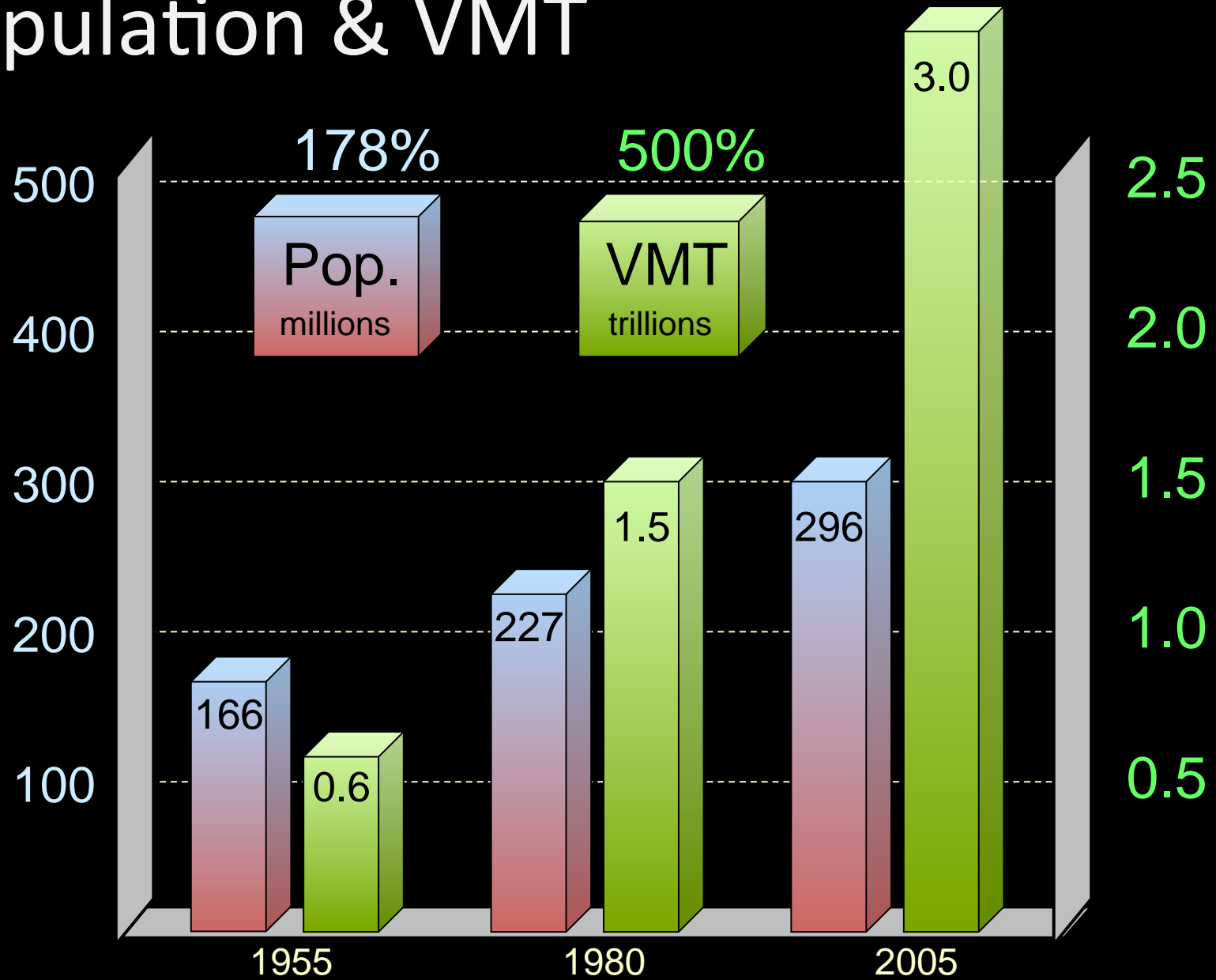
Transportation

Vehicle Miles of Travel



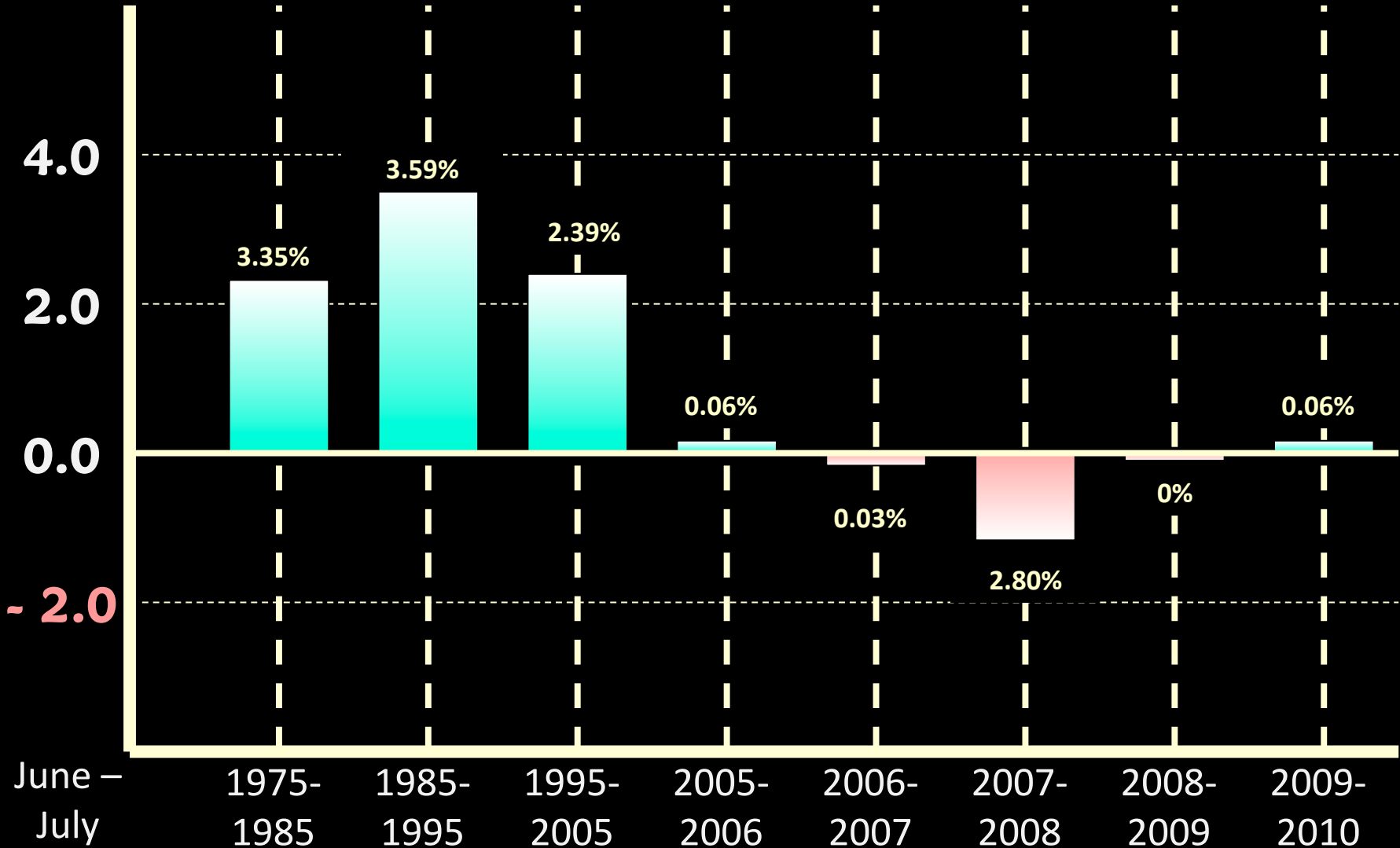
United States

Population & VMT

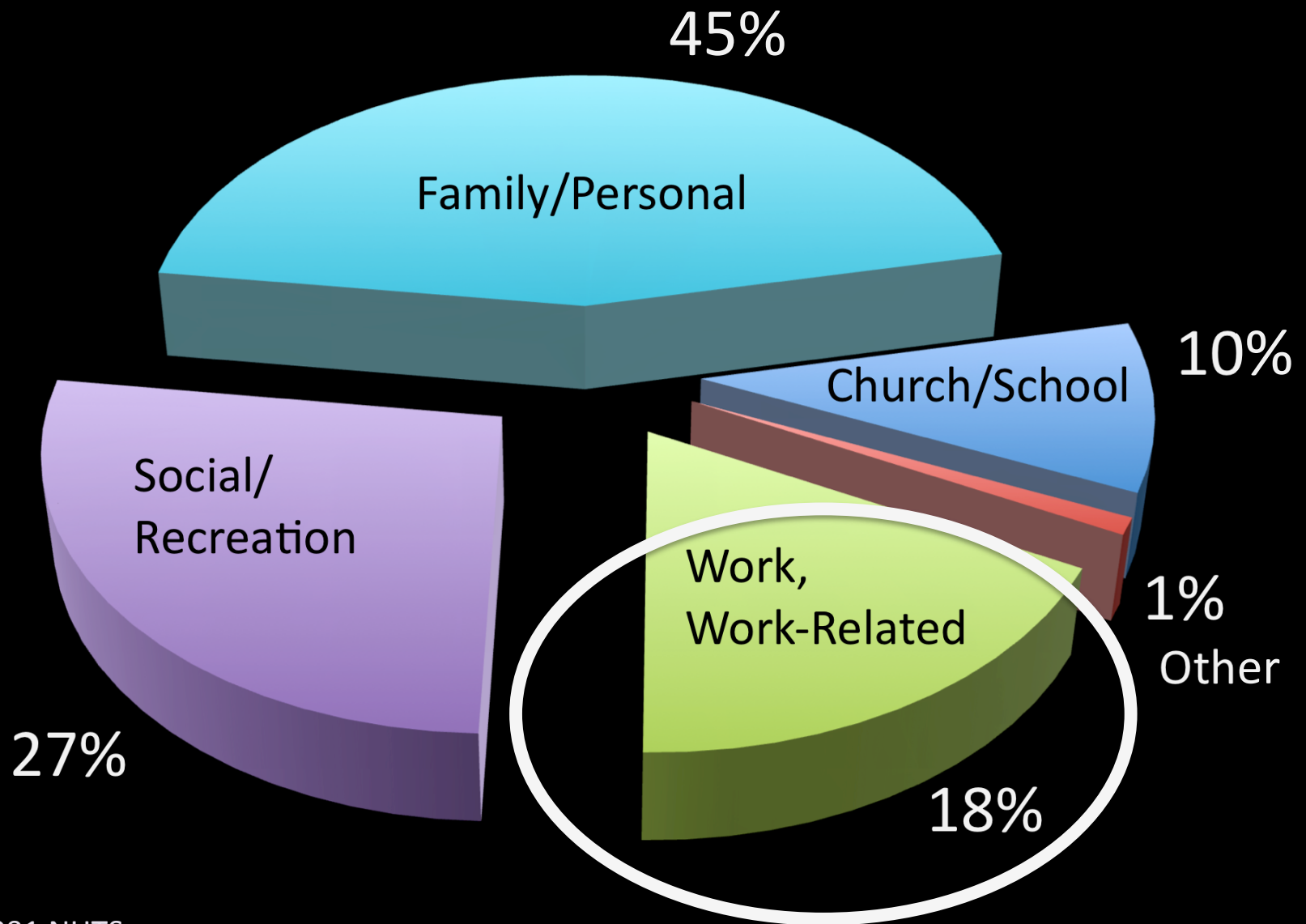


United States

Annual Rate of Change in VMT



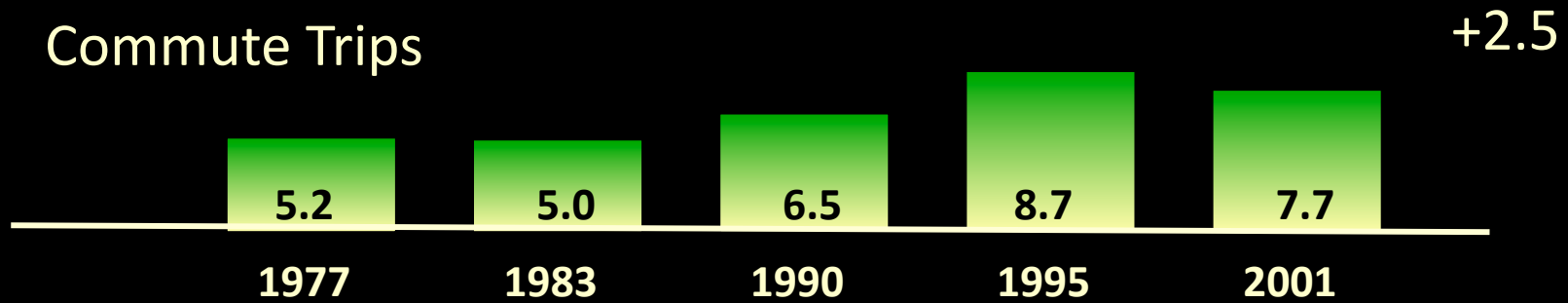
Daily Per Capita Travel



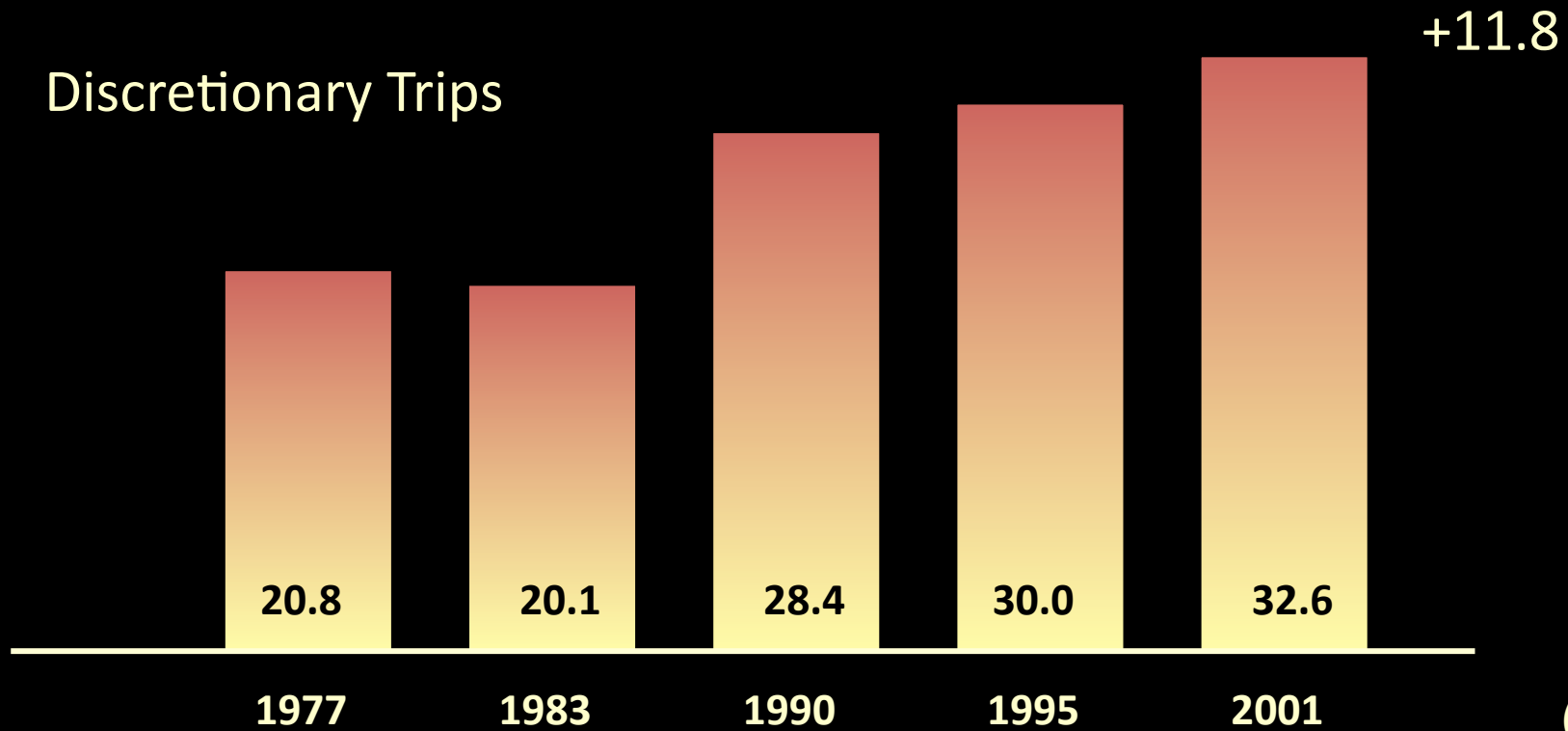
Source: 2001 NHTS

Daily Miles of Travel Per Capita

Commute Trips



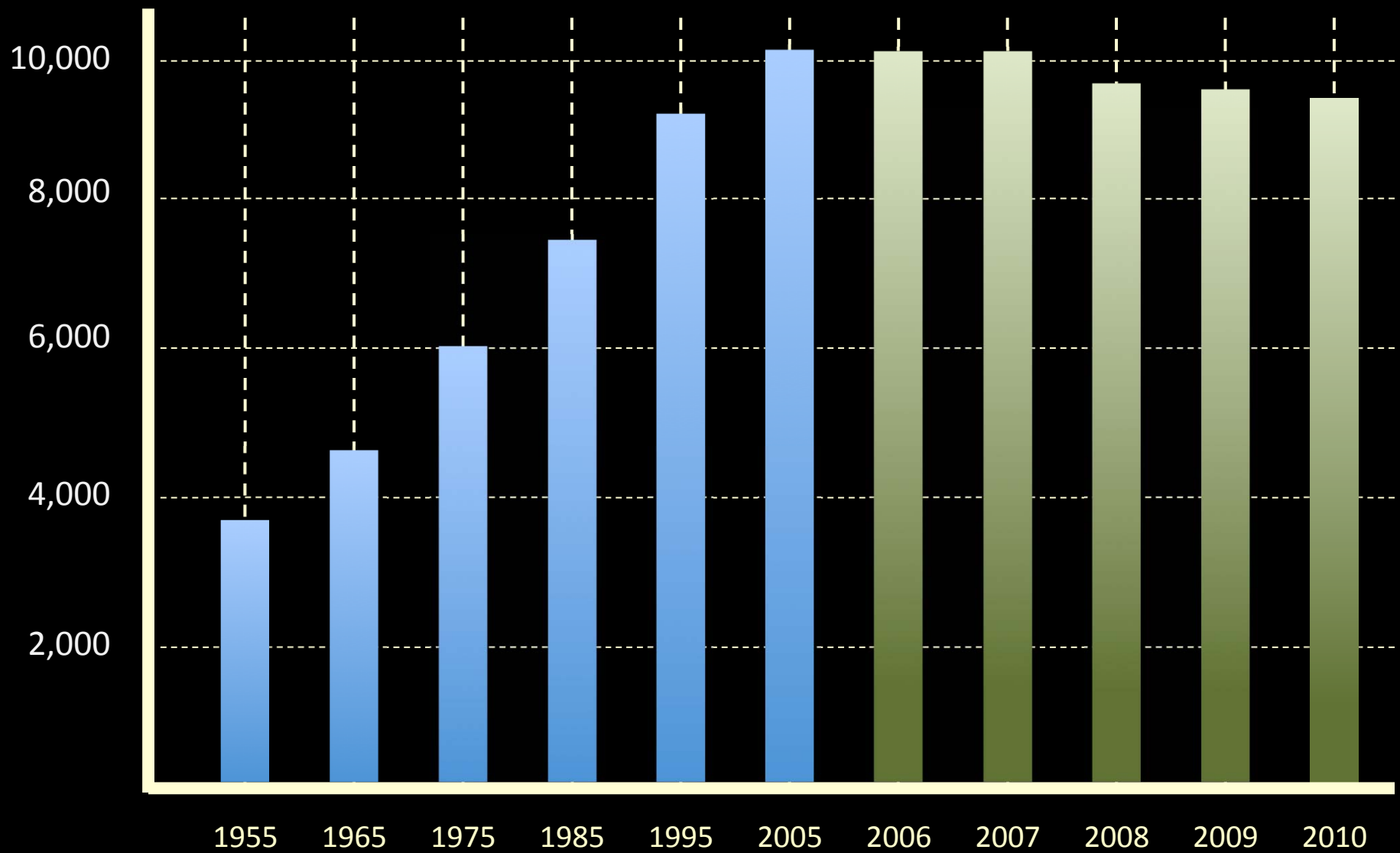
Discretionary Trips



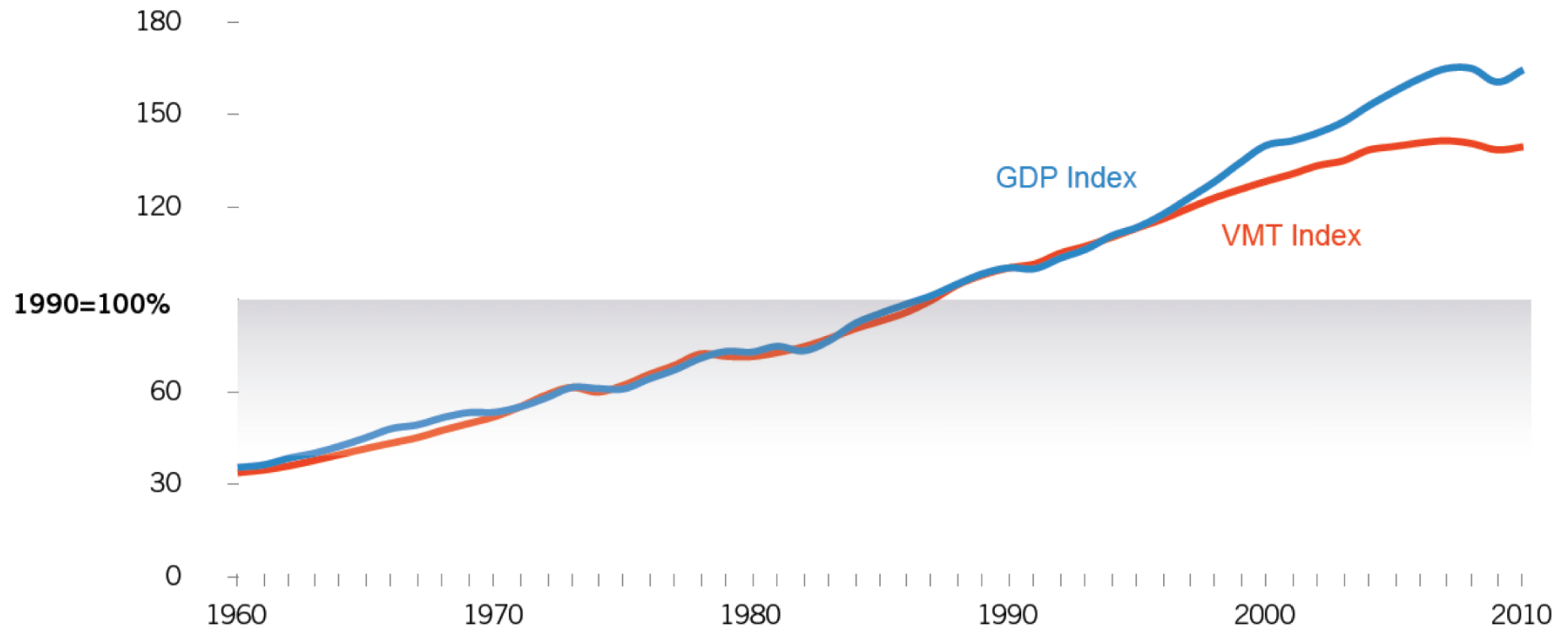
(NHTS)

United States

VMT per Capita



VMT and GDP

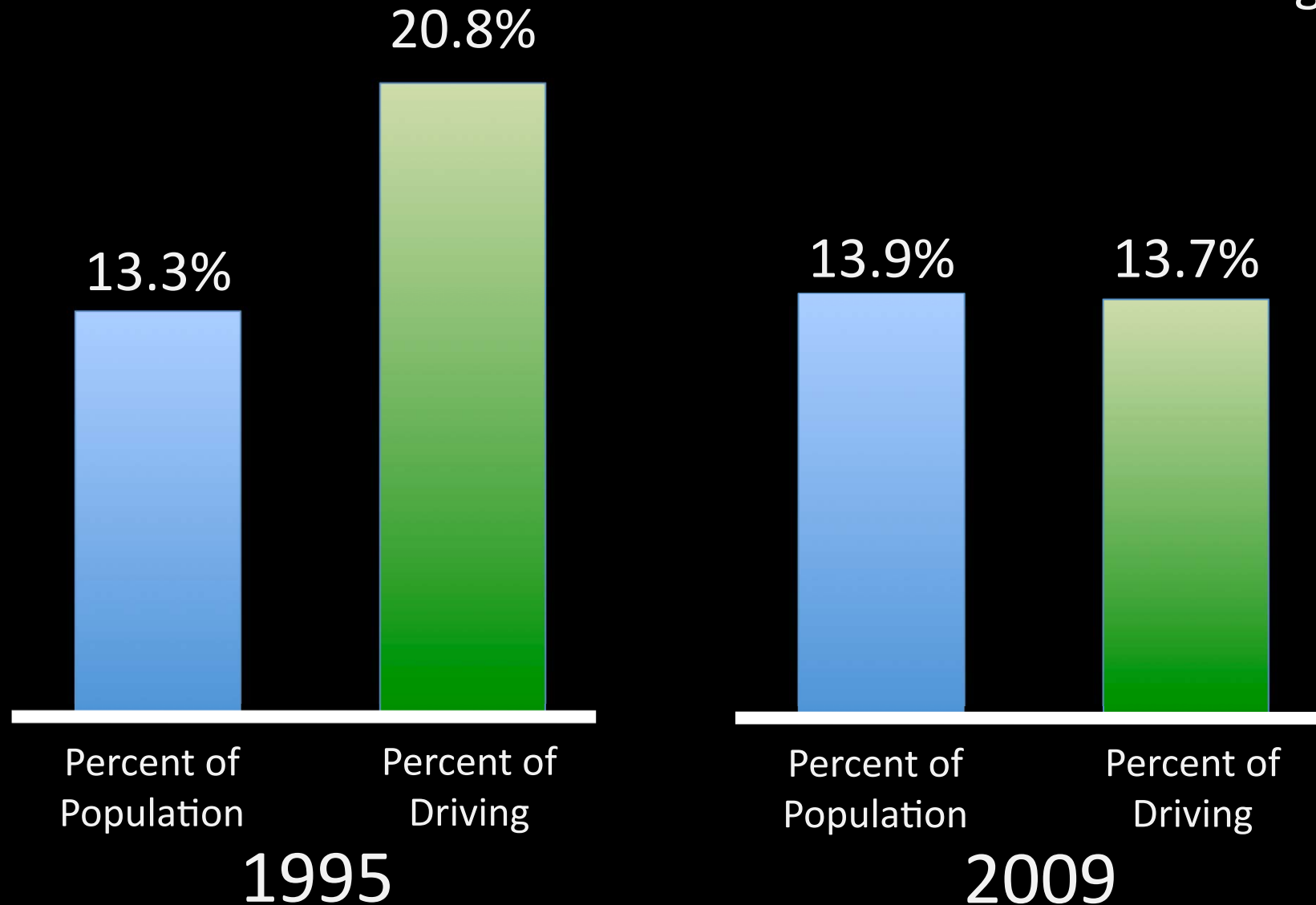


Data Sources: VMT: US DOT, BTS, Table 1-32: US Vehicle Miles, FHWA Traffic Volume Trends August 2010. GDP: BEA National Income and Product Account Table, Table 1.1.6 Real GDP, Chained (2005) Dollars

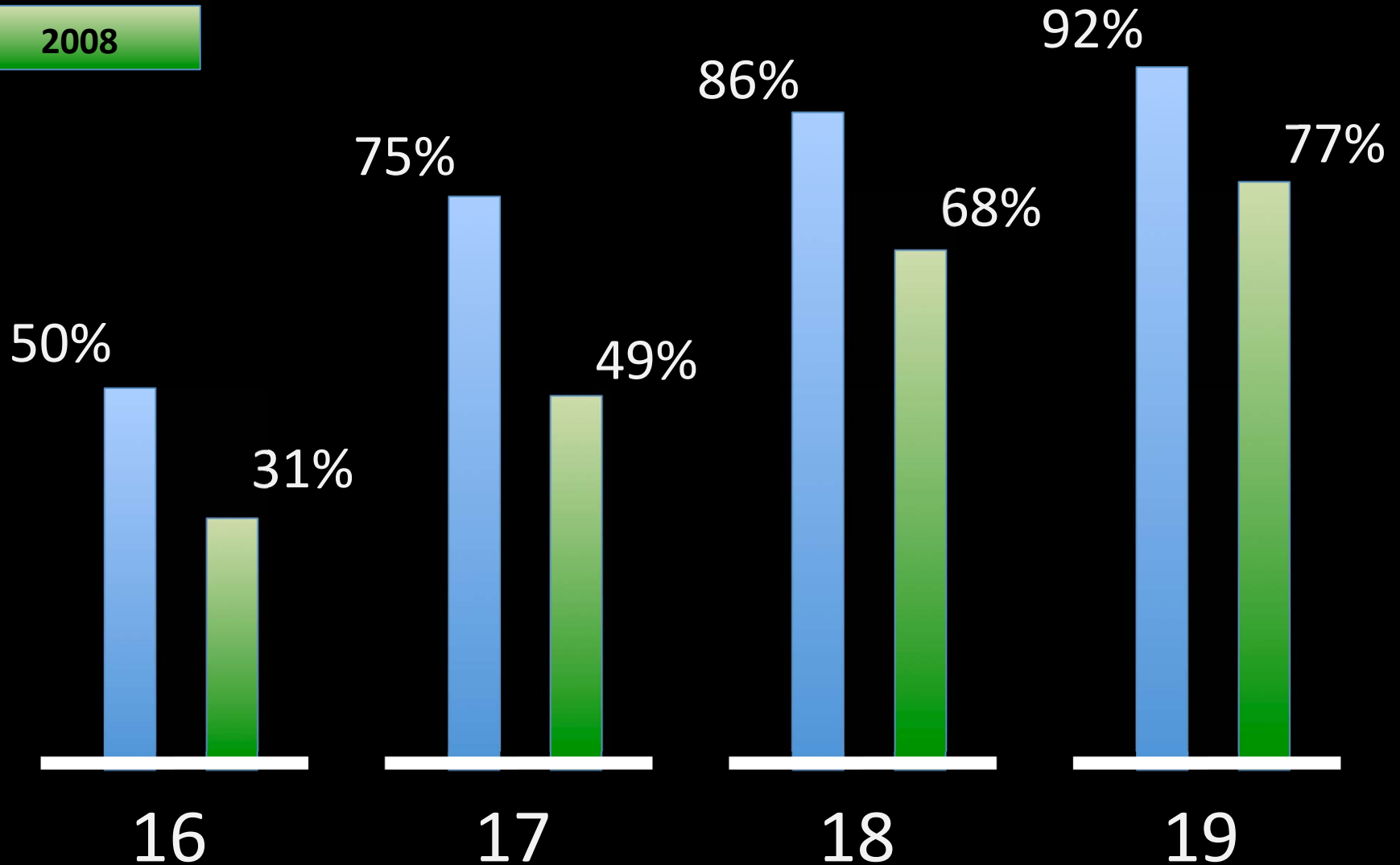
Source: "Growing Wealthier – Smart Growth, Climate Change and Prosperity"
January 2011 Center for Clean Air Policy

Millennials Are Driving Less

18 – 24 Years of Age

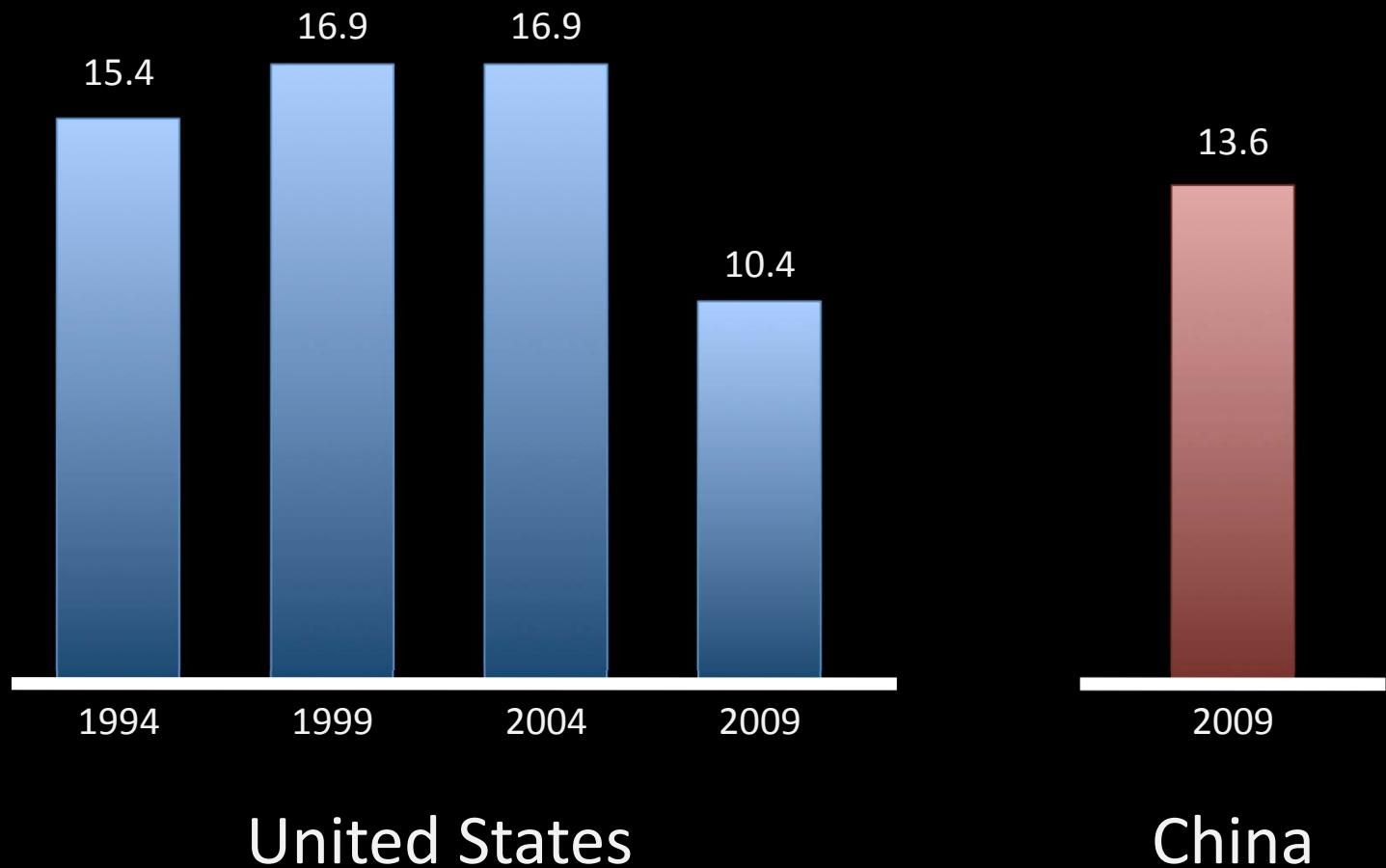


% With Driver's Licenses by Age



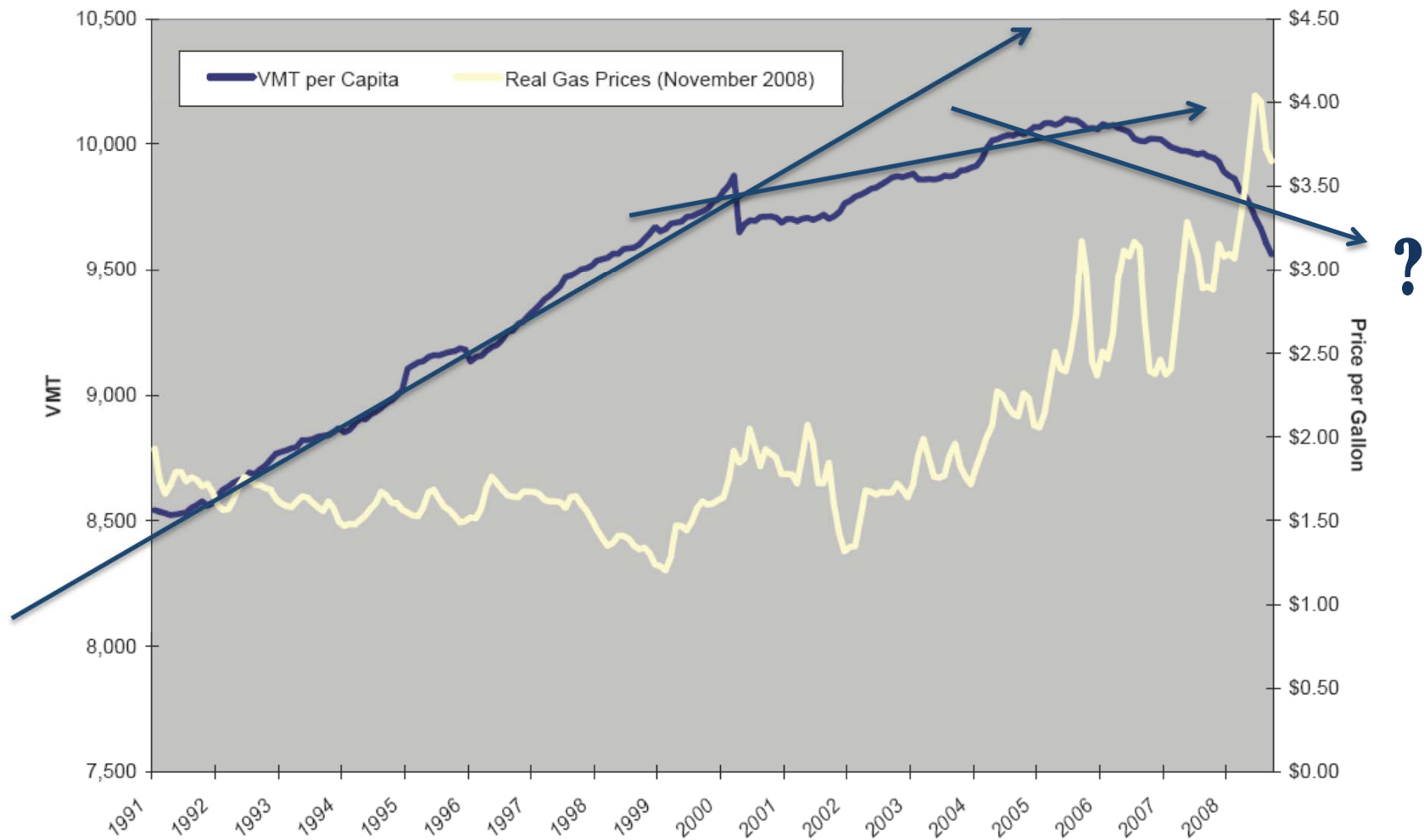
Annual Sales: New Motor Vehicles

Millions



Source: Bureau of Transportation Statistics

Figure 1b. U.S. Vehicle Miles Traveled Per Capita, Annualized and Real Gasoline Pump Prices, January 1991–September 2008

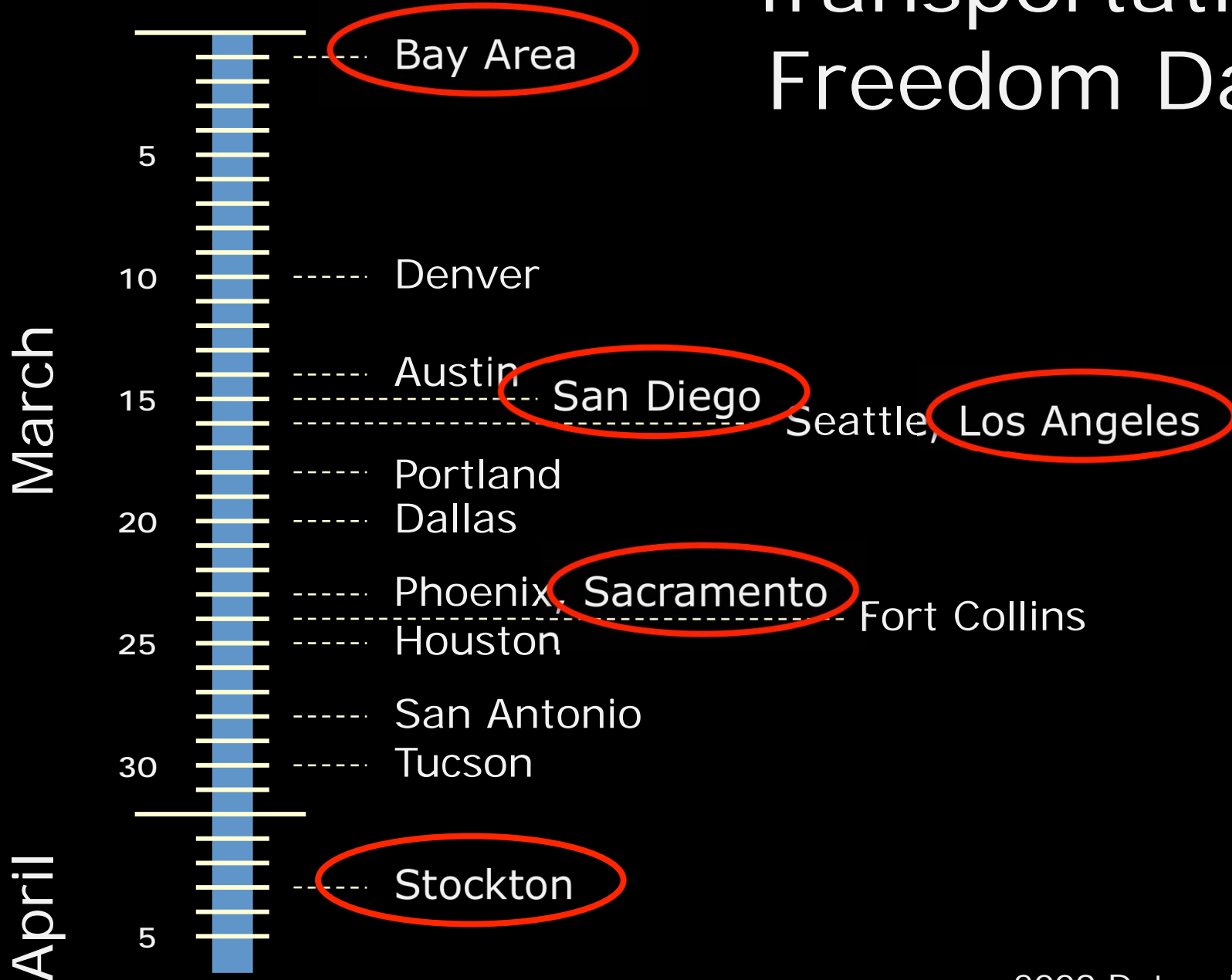


Source: Traffic Volume Trends and Energy Information Administration

6

Local Policy

Transportation Freedom Day



How Cities Will Compete

- Embedded daily VMT
- Vulnerability to petroleum prices



ALOHA Quality Gasoline	
Unleaded	3.21 $\frac{9}{10}$
Unleaded Plus	3.31 $\frac{9}{10}$
Super Unleaded	3.41 $\frac{9}{10}$

Strategies for Reducing Oil Dependence

• New Domestic Sources of Oil.....	+++	Impact on Cost of Travel
• Better Vehicle Efficiency.....	+	
• Shift to Electric Vehicles.....	++	
• Shift to Hydrogen Vehicles.....	+++	
• Shift to CNG Vehicles.....	++	
• Reduce VMT – Road Pricing.....	++	
• Reduce VMT – Carbon Tax.....	++	
• Mode Shift – Transit.....	++	
• Mode Shift – Walk/Bike.....	-	
• Shift Freight to Rail.....	+	
• Reduce VMT – Land Use.....	---	

NOT Your Father's Land Use Pattern



Thank You