Breaking the Cartel

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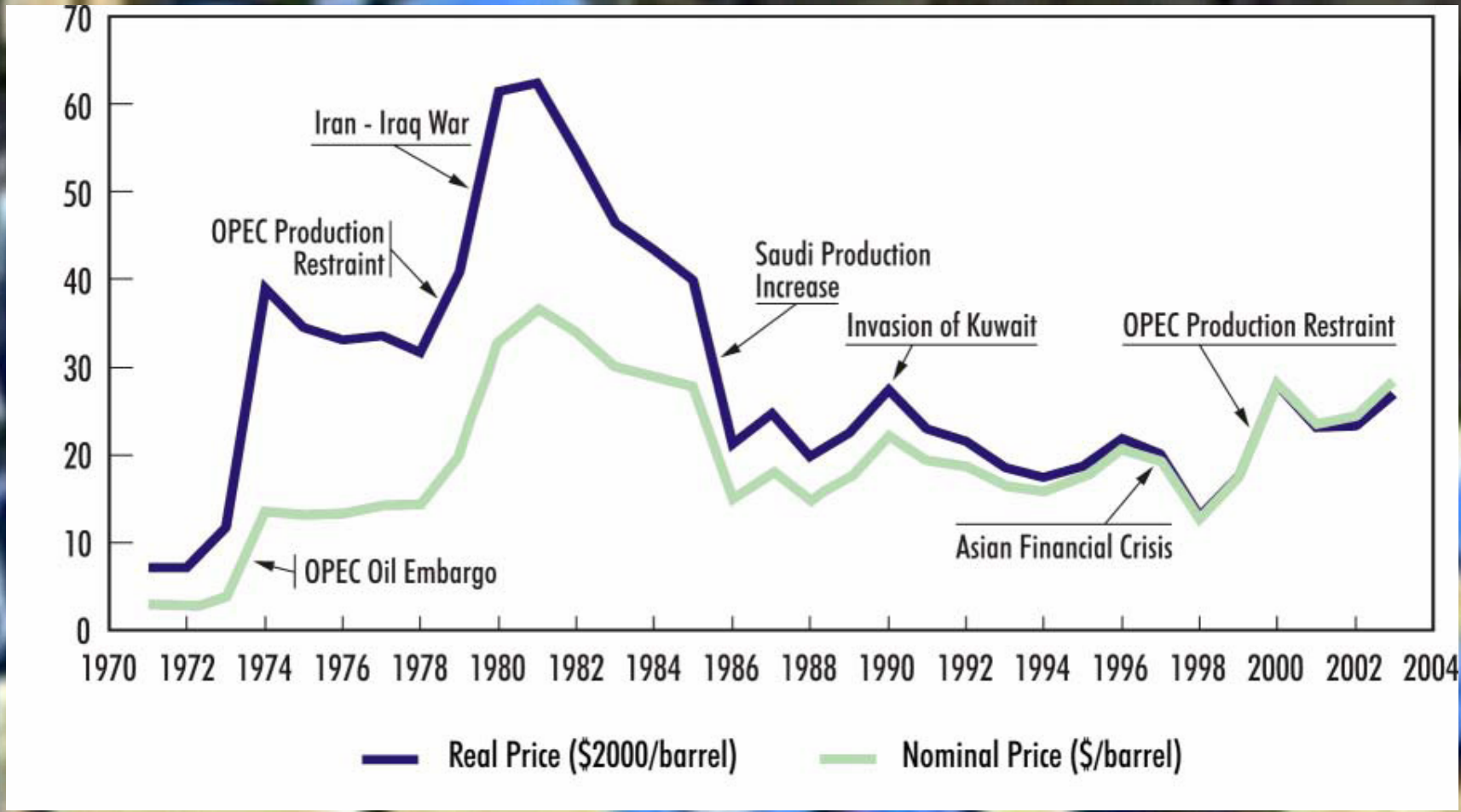
How Higher Oil Prices Affect the Global Economy

- The extent of the effect of a given price increase depends on the share of the cost of oil in national income, how dependent the country is on imported oil and the ability of consumers to decrease their use & switch away from oil.
- Higher oil prices lead to inflation, increased input costs, reduced non-oil demand and lower investment in net oil-importing countries.
- The advance to economic growth in oil-exporting countries provided is less than the loss of economic growth in importing countries.
- Net effect has always been negative

Average IEA Crude Oil Import Price



- Source: IEA

Impact on OECD Countries

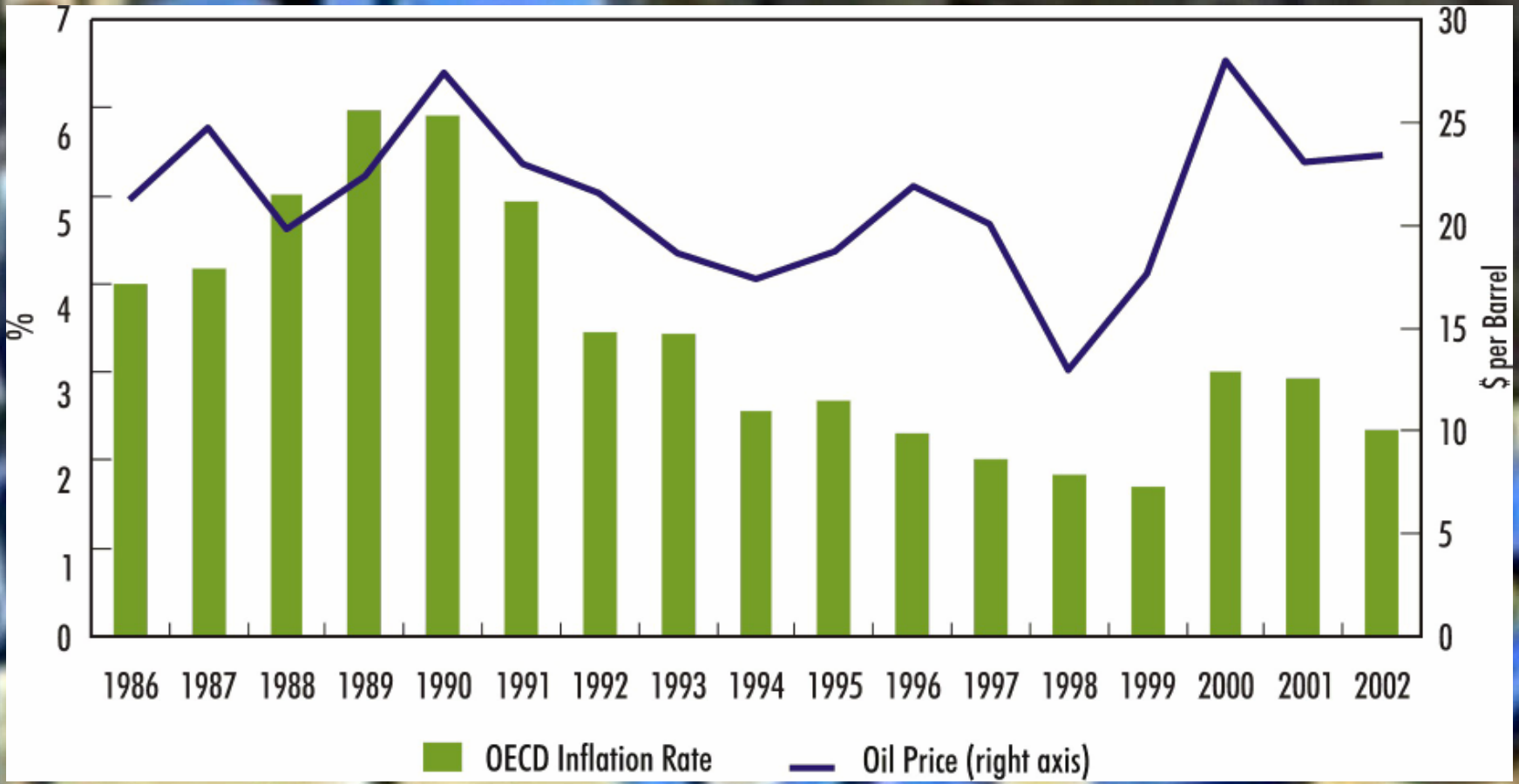
- Vulnerable to oil-price increases despite drop in the region's net oil imports
- The region remains greatly dependent on imports to meet oil needs, reaching to 52% in 2002.
- Oil imports cost the region an estimated $260 billion in 2003-about 1% of GDP
- Higher oil prices have a considerable unfavorable impact on OECD economic performance in the short term
- Impact in the longer term is more limited

OECD Macro-economic Indicators in Sustained Higher Oil Price Case

Column1	2004	2005
GDP	-0.4	-0.4
Consumer price index	0.5	0.6
Unemployment rate	0.1	0.1
Current account($billion)	-32	-42

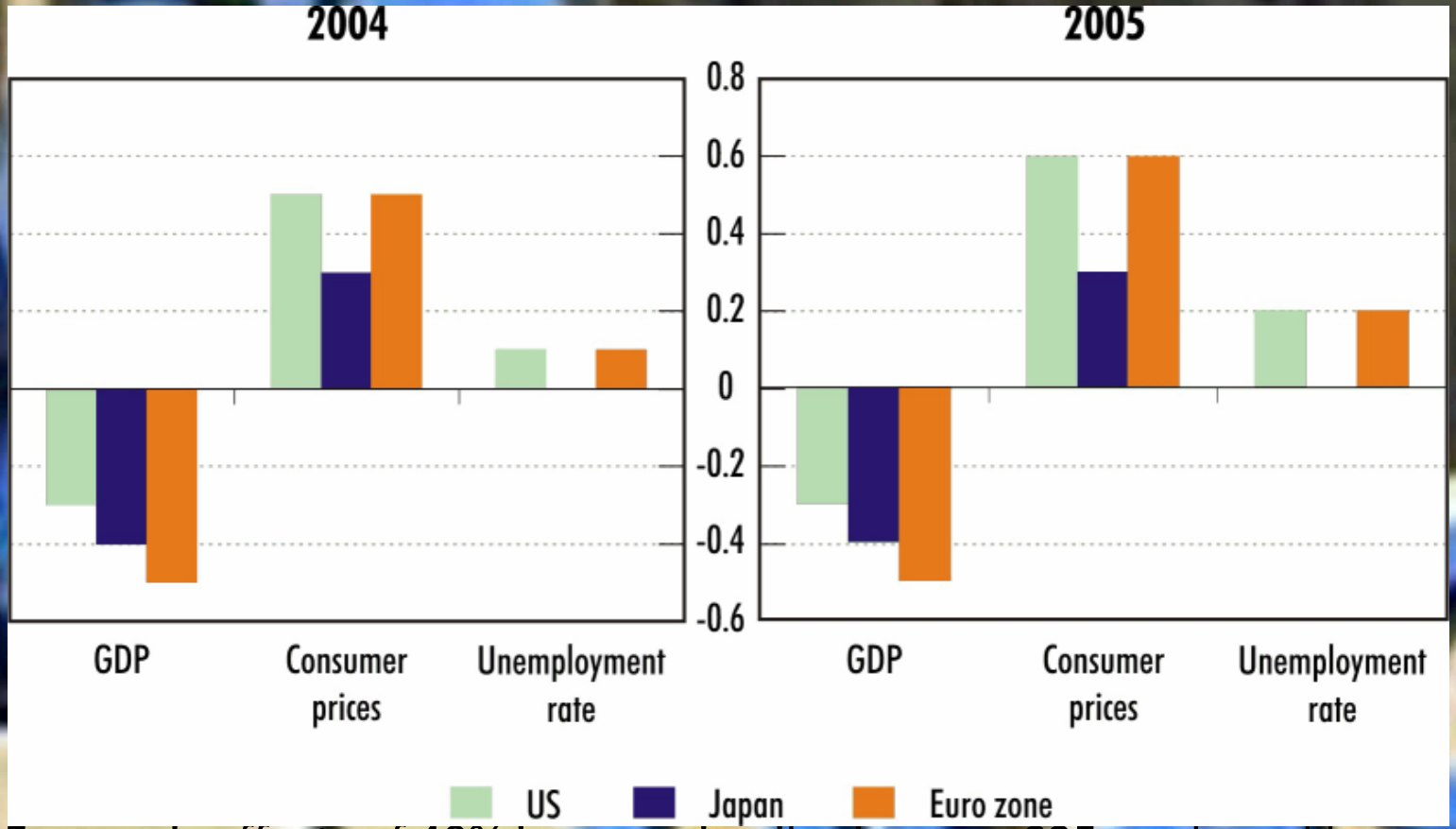
- Economic impact of 40% increase in oil prices from a $25 per barrel base
- Source: IEA

OECD Inflation Rate & Average IEA Crude Oil Import



- Source: IEA

OECD Macro-economic Indicators in Sustained Higher Oil Price Case by Region/Country



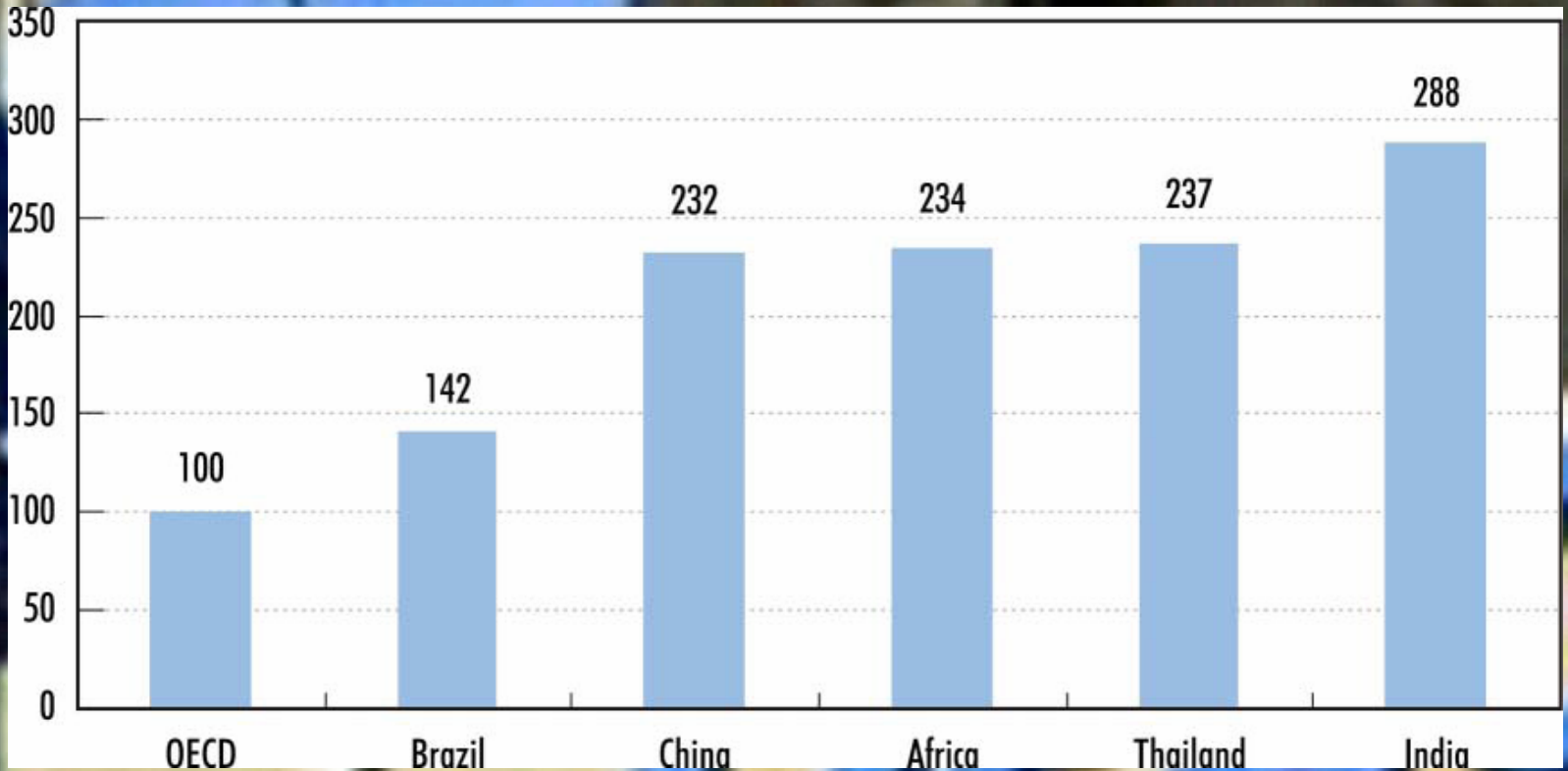
- Economic affects of 40% increase in oil price on a $25 per barrel base
- Source: IEA/OECD analysis

Impact on Developing Countries and Transitional Economies

- Economic impact is commonly more prominent than for OECD countries
- Sub-Saharan African countries with more oil intensive and fragile economies would endure a loss of more than 3% in GDP
- These economies are more dependent on imported oil
- Energy-intensive manufacturing generally accounts for a larger share of GDP
- Energy is used less efficient : on average they use more than twice as much oil to produce one unit of economic output

Oil Intensity in 2002

- 100 (base) units



- Source: IEA

Oil-Importing developing Country Macro-economic Indicators in Sustained Higher Oil Price Case after Year by Region/Country

Column1	Real GDP	Inflation	Trade Balance
Asia	-0.8	1.4	-1
China	-0.8	0.8	-0.6
India	-1	2.6	-1.2
Malaysia	-0.4	2	0
Philippines	-1.6	1.6	-2
Thailand	-1.8	0.8	-3
Latin America	-0.2	1.2	0
Argentina	-0.4	0.2	0.2
Brazil	-0.4	2	-0.4
Chile	-0.4	2	-1.4
Highly indebted poor dev. Countries	-1.6	n.a	n.a

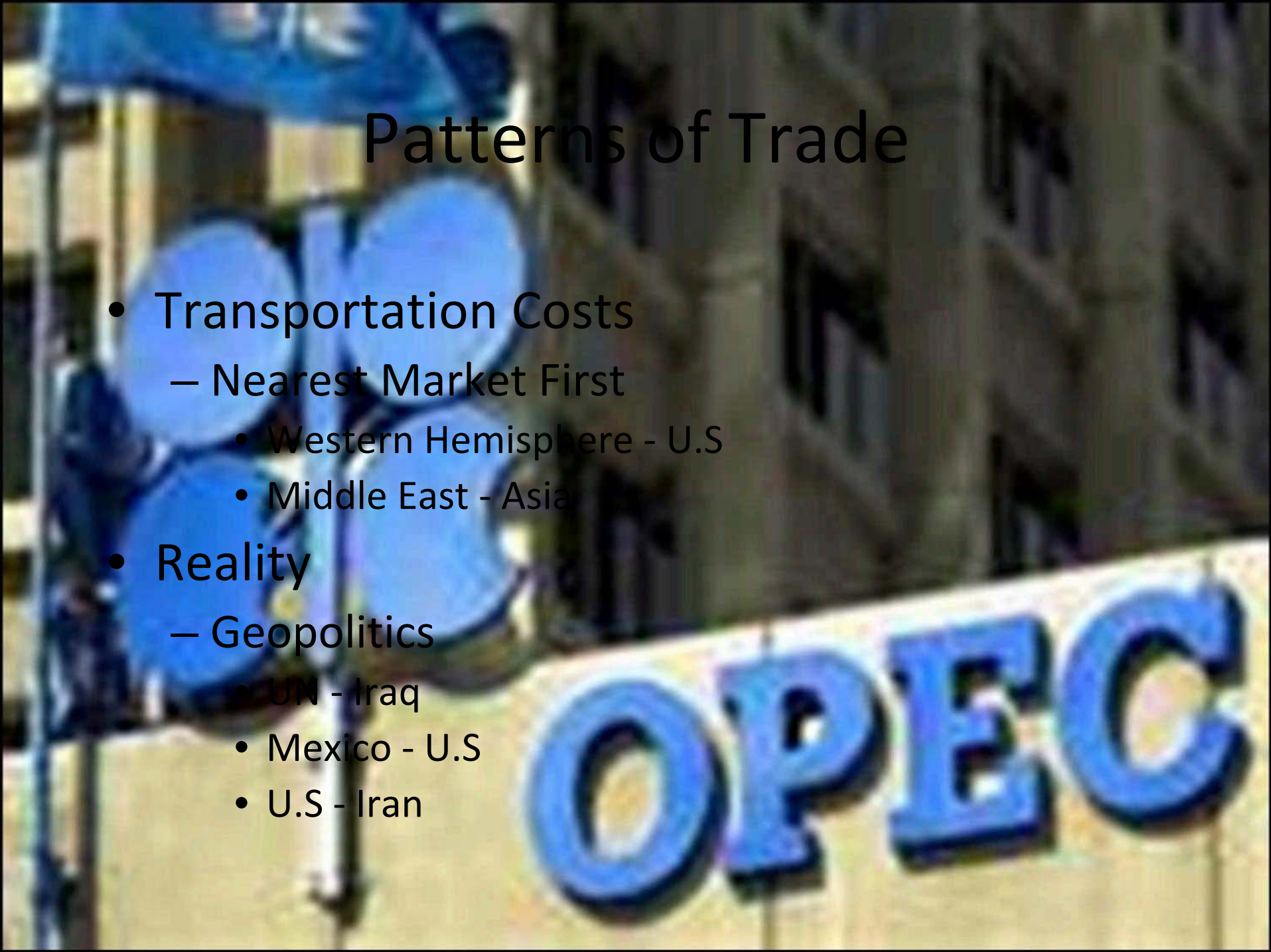
- Economic affects of 40% increase in oil price from base price of $25 per barrel
- Source: IEA based on IMF analysis

Oil Markets Deconstructed

- Macro
  - Patterns of Trade
    - Import Tendencies
- U.S Market
  - US Oil
  - US Regions
  - US Consumption
- Pricing
  - From the Barrel to the Pump
- Million Dollar Question

Patterns of Trade

- Transportation Costs
  - Nearest Market First
    - Western Hemisphere - U.S
    - Middle East - Asia
- Reality
  - Geopolitics
    - UN - Iraq
    - Mexico - U.S
    - U.S - Iran



Import Tendencies

OPEC Flows of Crude and Refined Oil, 2006
(Thousand Barrels per Day)

	Europe	North America	Asia and Pacific	Latin America	Africa	Middle East	Total World
Middle East							
IR IRAN	1,084	0	1,605	0	149	0	2,839
IRAQ	371	664	446	0	0	0	1,481
KUWAIT	317	154	1,956	0	46	0	2,473
QATAR	0	3	699	0	0	0	701
SAUDI ARABIA	1,163	1,501	4,721	85	340	497	8,307
UNITED ARAB EMIRATES	78	9	2,741	0	44	0	2,873
Africa							
ALGERIA	488	729	59	88	2	17	1,382
SP LIBYAN AJ	1,266	160	122	0	61	0	1,609
NIGERIA	638	1,597	64	0	0	0	2,299
ANGOLA	140	824	60	0	0	0	1,025
Asia/Far East							
INDONESIA	0	30	497	0	0	0	527
Latin America							
VENEZUELA	258	996	173	835	3	0	2,265

Source: OPEC (http://www.opec.org/library/Annual%20Statistical%20Bulletin/interactive/FileZ/Flowbot.htm

U.S Market: Production

- U.S - Third largest producer
  - Private Production
    - Higher prices - higher incentives

Top Producers

Country	Production
1. *Saudi Arabia*	10.72
2. Russia	9.67
3. United States	8.37
4. *Iran*	4.12
5. Mexico	3.71
6. China	3.84
7. Canada	3.23
8. UAE	2.94
9. *Venezuela*	2.81
10. *Norway*	2.79
11. *Kuwait*	2.67
12. *Nigeria*	2.44
13. Brazil	2.16
14. *Iraq*	2.01

urce: www.eia.doe.gov/emeu/cabs/

U.S Consumption

- Transportation: 2/3
  - Unique in U.S and Canada
- Substitution Effects
  - Non-Transportation:
    - Embargo - Construction
  - Transportation:
    - SR - little
    - LR - almost none

Pricing

(From The Barrel To The Pump)

- Final Product Heterogeneity
  - Refined by final consumption
    - Exchange prices (NYMEX)
- At the Pump
  - LR equilibrium

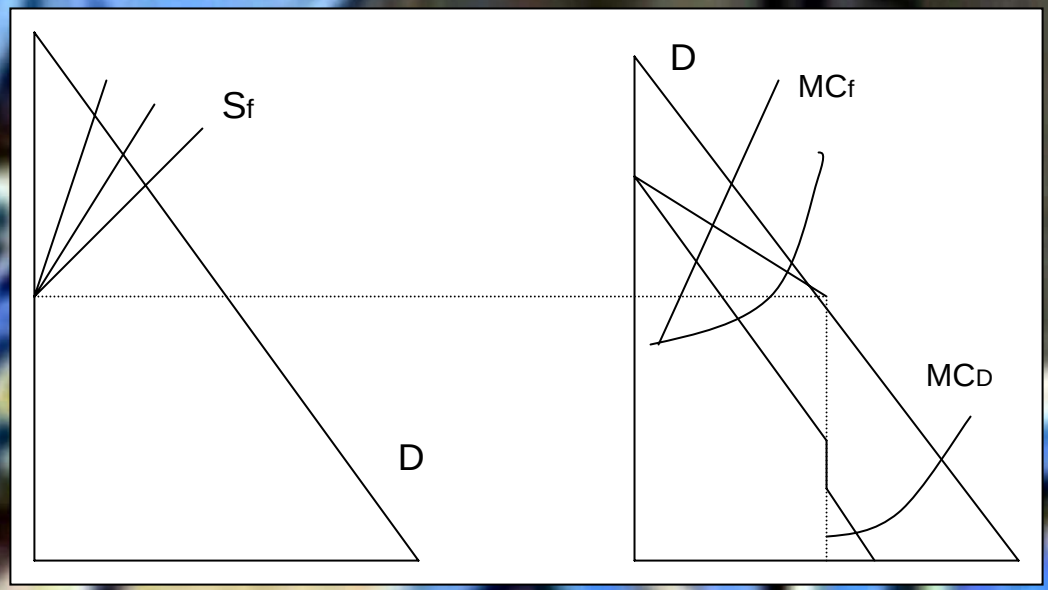
Million Dollar Question

- U.S largest importer
  - North America 3rd
    - Mexico + Canada $\rightarrow\rightarrow\rightarrow$ U.S
- Extraction - Pump
  - Global segmentation
    - How does OPEC have power?

Global Prices

Model

Competitive Fringe



- Ideas:
  - Increase world supply by reducing demand
  - Localize sourcing

New Resource Discoveries

Increasing production and cutting of the supplier

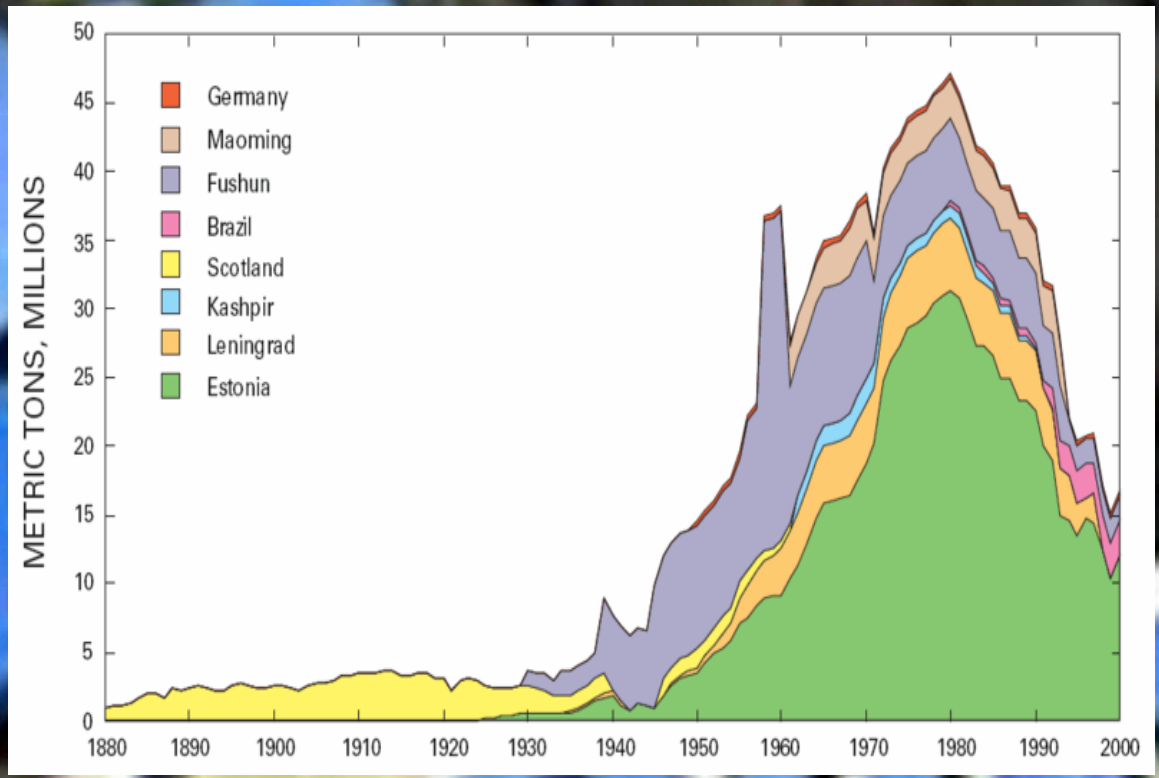
Oil Shale

- U.S. has the largest amount of oil shale in the world
- Most located in Green River Formation (Colorado, Utah, Wyoming)
- There is estimated 800 billion barrels of recoverable oil
- More than 70% of the oil shale is under control of the U.S. government

Oil Shale Research

- Current research projects by Shell and Chevron
- Could be commercial production by 2015
- Expected to be profitable as long as price above $30 per barrel
- Energy Department forecasts 2 million barrels/day by 2020
- Also forecasts eventual production of 10 million barrels/day

Oil Shale Global Production



- Above is the production of oil shale worldwide since 1880
- Production follows the price of oil

Global Tar Sand Location

- Much of the world's oil is in the form of tar sand (about 2 trillion barrels)
  - Largest deposits can be found in Canada and Venezuela
  - The U.S has an estimated 12 to 19 billion barrels of oil in the form of tar sand located in Utah
- Current production
  - Canada about 1 million barrels/ day
  - CERA projects about 3 million barrels/ day by 2020

Challenges to Inovation

- The three main obstacles to these methods
  - social and economic impact on local communities
  - High cost of producing this oil
  - Environmental concerns

Transportation Sector

(Increase supply by reducing consumption)

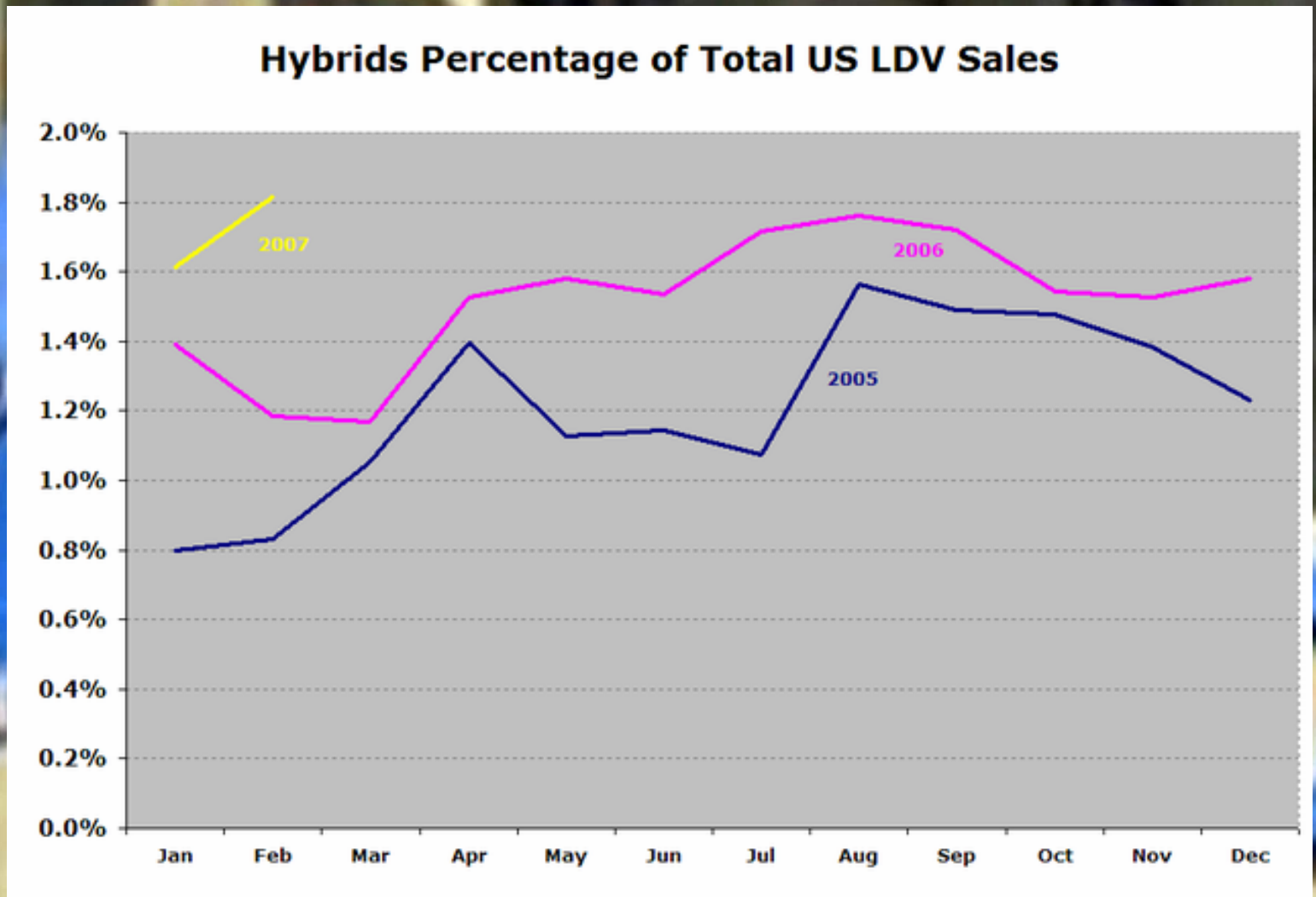
- The majority of Oil consumed in the U.S. is in the transportation sector
  - In the U.S. 2/3 of all oil consumed is used in the transportation sector
- The U.S. transportation sector uses 9.25 million barrels of oil per day
  - 388.6 million gallons per day
  - 141,839 million gallons per year

Ethanol

- What is it?
  - Biolfuel alternative to gas that can be produced from sugar cane, corn, etc.
- Current Usage
  - 7 billion gallons produced in 2007
  - 12 billion gallons by the end of 2009
- Projected usage
  - U.S. Energy Independence and Security Act of 2007 requires American "fuel producers to use at least 36 billion gallons of biofuel in 2022. This is nearly a fivefold increase over current levels.
  - Even if ethanol is produced with renewable energy, the consumption of ethanol to replace current U.S. petroleum use alone would require about 75% of all cultivated land on the face of the Earth, with no ethanol for other countries, or sufficient food for humans and animals.
- Impact on market
  - If all U.S. corn production was used for ethanol it would only displace 12% of U.S. consumption
  - Currently this is 4.9% of current gas consumption
  - In 2022 this is 25.38% of current gas consumption

Hybrids and HPEVs

- What are they?
  - A vehicle that uses a rechargeable energy storage system and a fueled power source
  - A hybrid vehicle with batteries that can be recharged by connecting a plug to an electric power source
- Current Usage
  - As of April 2008, plug-in hybrid passenger vehicles are not yet in production
  - Over 500,000 Toyota hybrids sold in the U.S. between 2000 and 2007
- Impact on Market
  - In 2004 average fuel economy of cars was 24.6 mpg
  - Hybrids can get up to 48 mpg and PHEVs over 100
  - In 2008, a PHEV can travel 30 miles for just US$ 1.04 (the same mileage as a gallon of gasoline costing $3.00.)
  - According to the national renewable energy laboratory from 1999-2006 215 million gallons of gas have been saved by driving hybrids
  - a massive influx of PHEVs could reduce gasoline use by 31-43% without stressing grid capacity


Hybrids Percentage of Total US LDV Sales
2.0%
1.8%
1.6%
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
2007
2006
2005
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Biodiesel

- What is it?
  - Biodiesel is a renewable fuel produced from agricultural resources such as vegetable oils. In the United States, most biodiesel is made from soybean oil; however canola oil, sunflower oil, recycled cooking oils, and animal fats are also used.
  - Can be blended with traditional diesel and used in any diesel engine car
- Current Usage
  - In 2004 25 million gallons of B100 were sold and in 2005 it had tripled to 75 million gallons
- Impact on Market
  - Current production is only .05% of gas consumption
  - Expansion of the biodiesel industry as estimated will displace 242 million barrels of crude oil between 2006 and 2015.
    - This is only 7% of current U.S. annual consumption
  - Because of this, $13.6 billion (2005 dollars) will remain in the American economy instead of being spent on oil imports

Hydrogen Fuel Cell

- What is it?
  - Fuel cells generate power through an electrochemical process, much like a battery. They convert chemical energy to electrical energy by combining hydrogen from fuel with oxygen from the air.
  - Hydrogen is an energy carrier, not an energy source, so the energy the car uses would ultimately need to be provided by a conventional power plant.
- Current usage
  - Requires energy to produce
    - This still reduces petroleum b/c most energy in US comes from coal
  - In 2005 there were only 25,000 gallons used
  - CA only has 2 hydrogen fuel stations and will need about 200
- Projected usage
  - The use of hydrogen for all US transport would require some 200 Mt/yr of hydrogen (not likely in the near future)
- Impact on market
  - No immediate impact b/c it requires a whole new infrastructure and currently costs more than gasoline
  - Potentially replace gasoline completely, but this is very unlikely as there are numerous barriers to its widespread usage

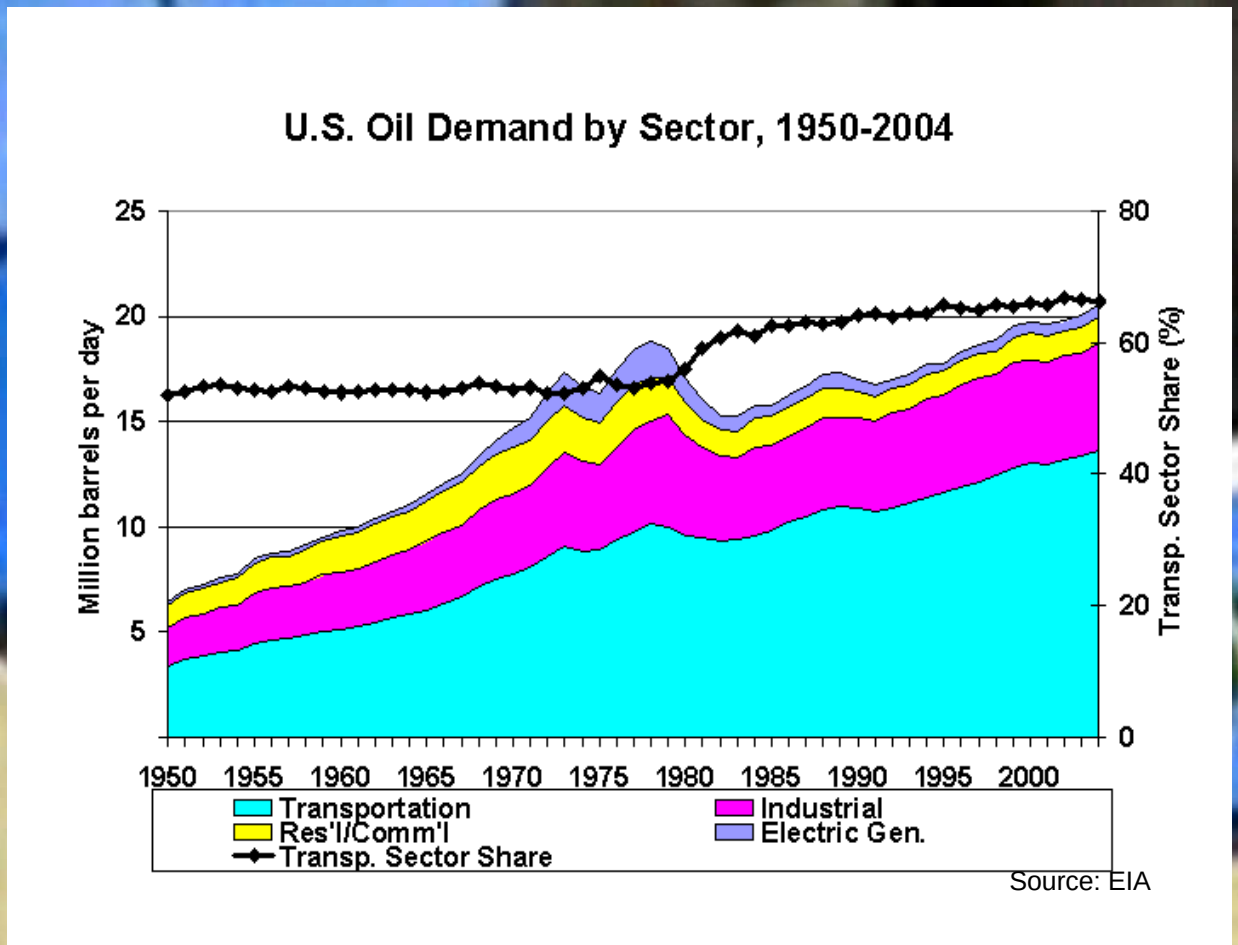
Combined Impact on Market

- Current
  - 4.97% of total annual fuel consumption
- Future
  - By 2022 could displace up to 67.38% of today's annual fuel consumption
    - Not including hydrogen b/c future usage is unknown

Oil Demand in the Non-Transportation Sector

(Reducing demand increasing supply)

- The non-transportation sector consists of:
  - Residential/Commercial—space heating in buildings
  - Industrial—power to run factory equipment
  - Electricity generation



Source: EIA

Global Oil Demand in the Non-Transportation Sector

•In the years since the Arab Oil Embargo of 1973/74, price and policy encouraged the substitution where possible of other fuels for oil--in the non-transportation sector.

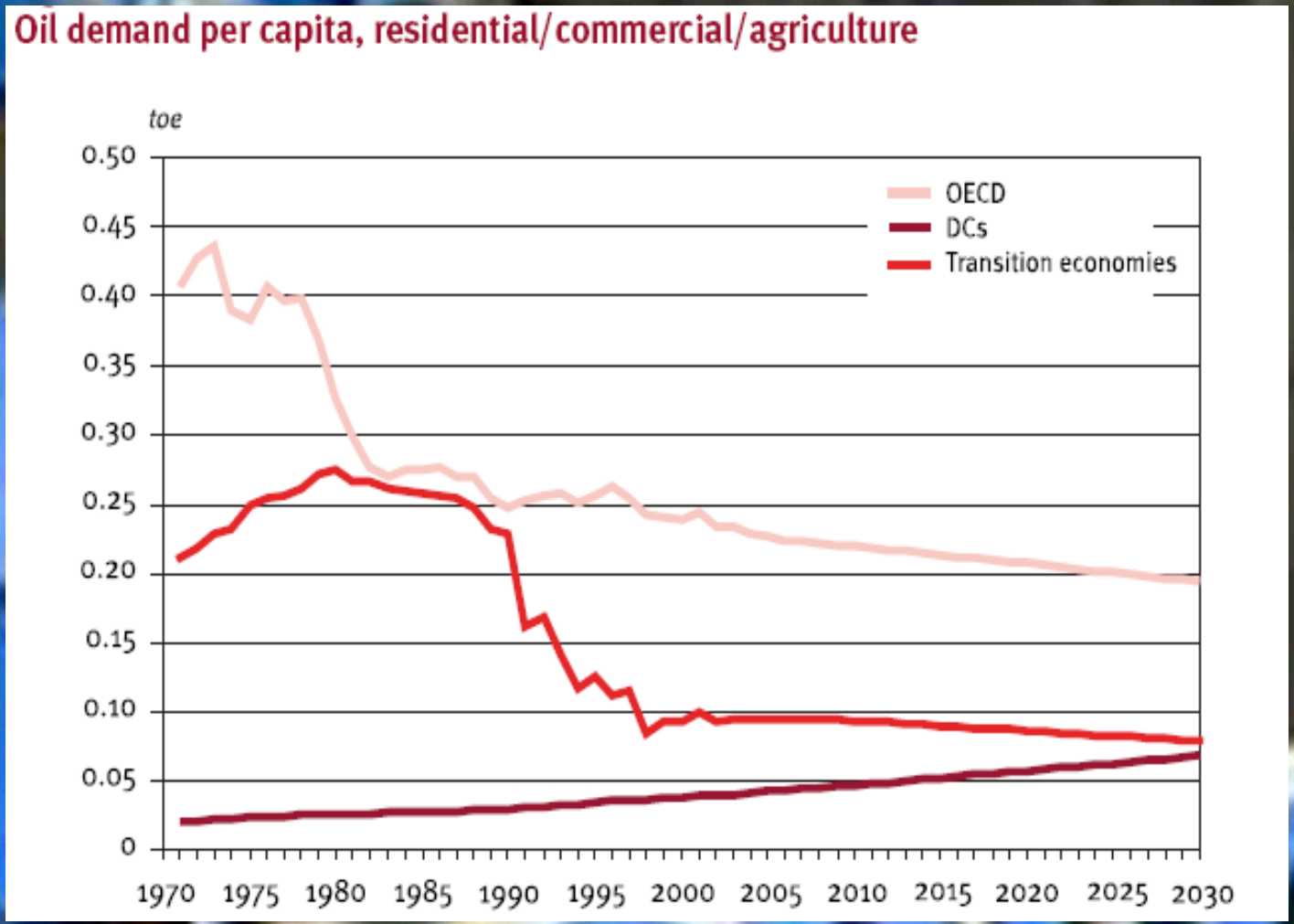
• Many Latin American countries and OPEC member countries, however, still rely on oil for a large portion of electricity generated.
In the U.S, oil accounts for less than 20 percent of the energy consumed for non-transportation uses.

• Coal accounts for the largest share of electricity generated, and the global share of natural gas has risen steeply in the last two decades.

• The contribution of non-fossil fuels in electricity will increase over the next two decades.

• With these factors in mind, it is not expected that oil demand will experience growth to any significant degree in the electricity generation sector.

Oil demand per capita, residential/commercial/agriculture

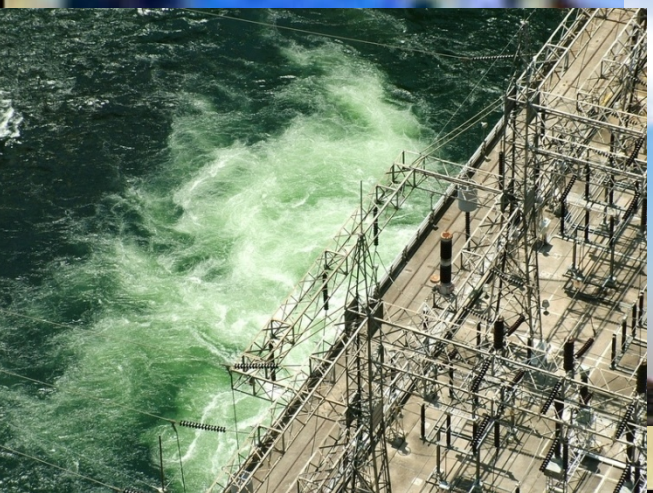


Source: World Oil Outlook

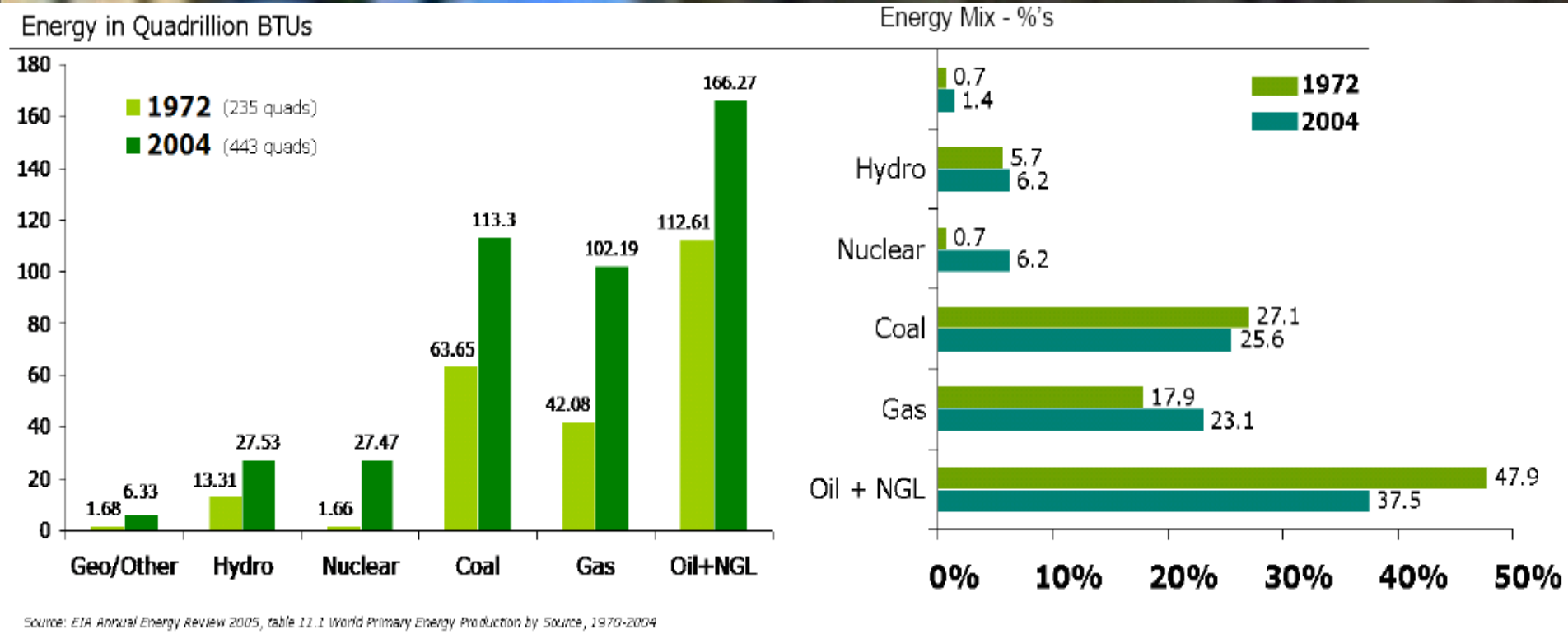
The main expected source of increase for non-transportation oil use will be in the industrial and residential sectors of developing countries. Industry's share of GDP has fallen in OECD regions, whereas the share has been rising in many developing countries. Very little net industry growth in oil demand in OECD or transition economies is expected over the coming decades. However, demand in developing countries is set to increase by over 6 mboe/d, more than 90% of the total industry demand rise.

Potential of Renewables to Decrease Demand for Oil in Non-Transportation Sector

- Non-bio renewables—hydropower, wind, solar, and nuclear—do not produce liquid fuels that compete with petroleum products, but generate electricity or heat that displaces natural gas or coal, which are then made available for other uses. Non-bio renewables have common characteristics:
  - High fixed costs of construction or fabrication and installation
  - Low operating costs, with minimal fuel or feedstock expenses
  - Economics of scale that have not been fully exploited
- Rapid growth is expected especially of wind and solar power generation, but most forecasts of future energy supplies suggest that total contributions from renewable energy installations will remain small for the next two decades.



Renewable Energy Contribution to Global Electricity

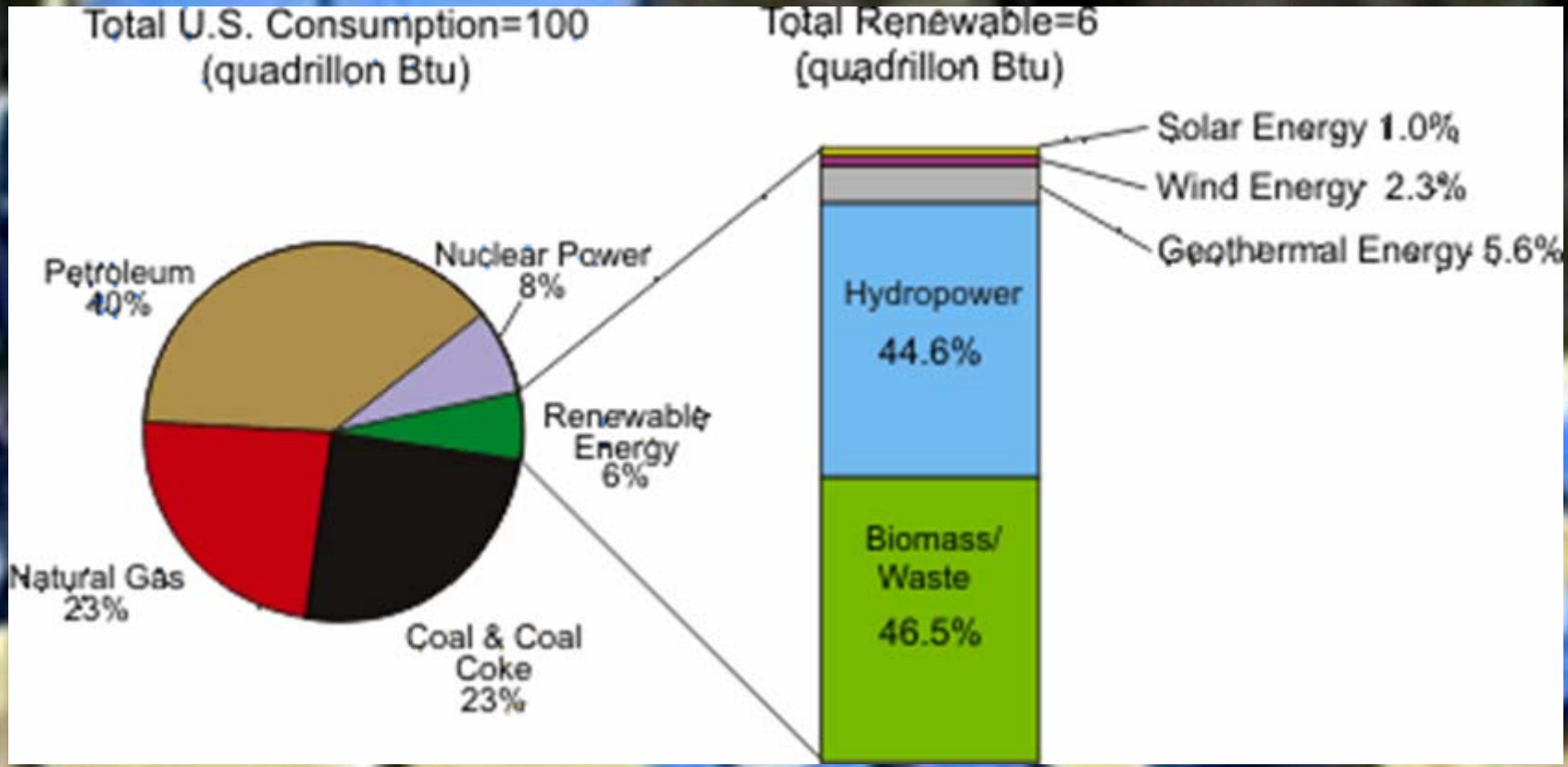


Source: EIA Annual Energy Review 2005, table 11.1 World Primary Energy Production by Source, 1970-2004

Excluding hydropower, renewable energy already contributes 38 GW of electrical generation globally, a figure that has been growing at 8.5% per year over the last five years. If these rates were sustained, these sources could provide up to 4% of global electricity by 2030.

Contribution of Renewable Energy to U.S. Energy Consumption

In 2004:



Source: EIA

The Movement Towards Improved Energy Efficiency and Reduction of Energy Consumption

- Renewable energy sources are encouraged as having a minimal environmental impact when compared to fossil fuels. They are also viewed as more secure than imported fossil fuels.
- There is significant pressure to reduce energy consumption in the U.S. The potential to reduce energy consumption in U.S. residential and commercial sectors is sizeable.
  - Anticipated energy use in the residential and commercial sectors could be reduced by roughly 15 to 20 percent through deployment of cost-effective energy-efficient measures that use existing, commercially available technologies.
  - Energy efficiency opportunities exist for reducing energy use by about 15 percent broadly across the industrial sector. Areas of opportunity include waste heat recovery, separations, and combined heat and power.
- A mix of tax incentives, subsides, and mandates is making renewables much more attractive than they would be based on their actual costs.

Effects of Rising Oil Prices Short and Long Run Effects

Direct effects towards rising gasoline prices and its relation to consumption

Short Run Effects

- Consumers not very responsive in Short Run
- Change in Driving Behavior
- Other modes of Transportation
- Planning trips and errands based on driving

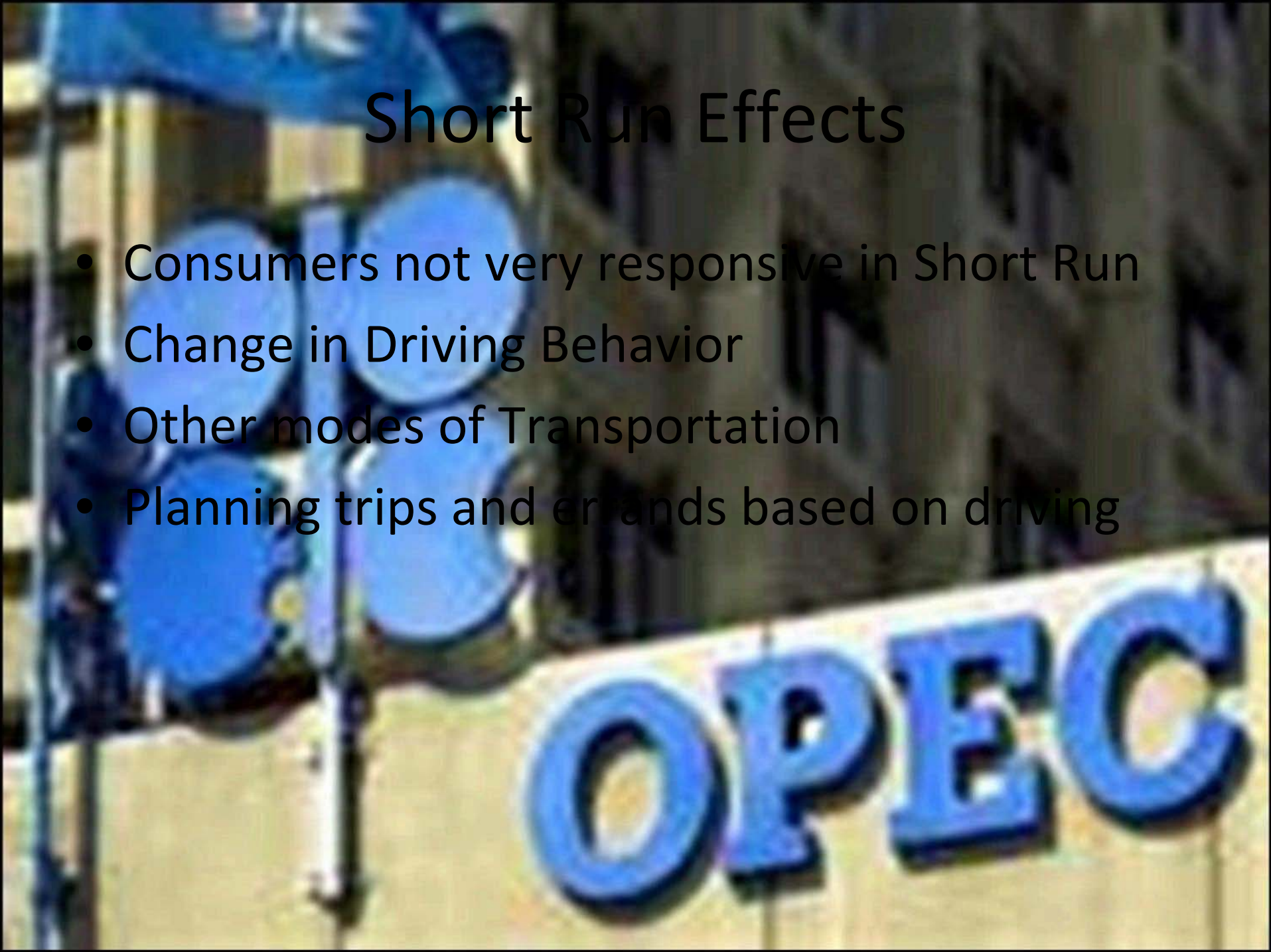
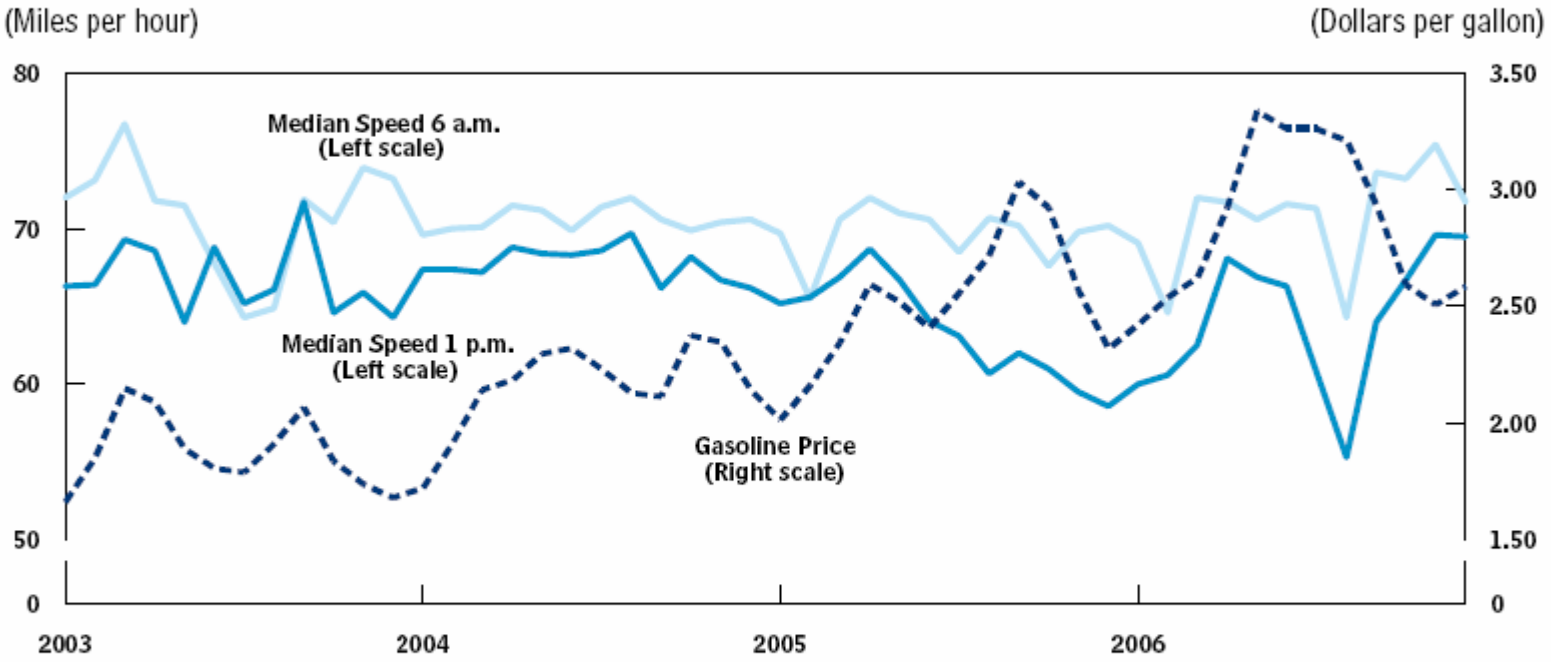


Figure A-3.

Median Weekend Speeds on I-405, Orange County, California, and Gasoline Prices



Sources: Congressional Budget Office based on data from the Freeway Performance Measurement Project, https://pems.eecs.berkeley.edu.

Note: Speeds were recorded at 6 a.m. and 1 p.m. each Saturday and Sunday from 2003 to 2006 by sensors located on southbound Interstate 405 at Newland Street, Westminster, California. Prices are nominal average California retail gasoline prices for all grades and formulations.

Long Run Effects

- Consumers are more responsive to a price increase
- Career and Housing choices dependent on commute
- Car purchasing dependant on MPG
- Alternative modes of transportation looked upon.

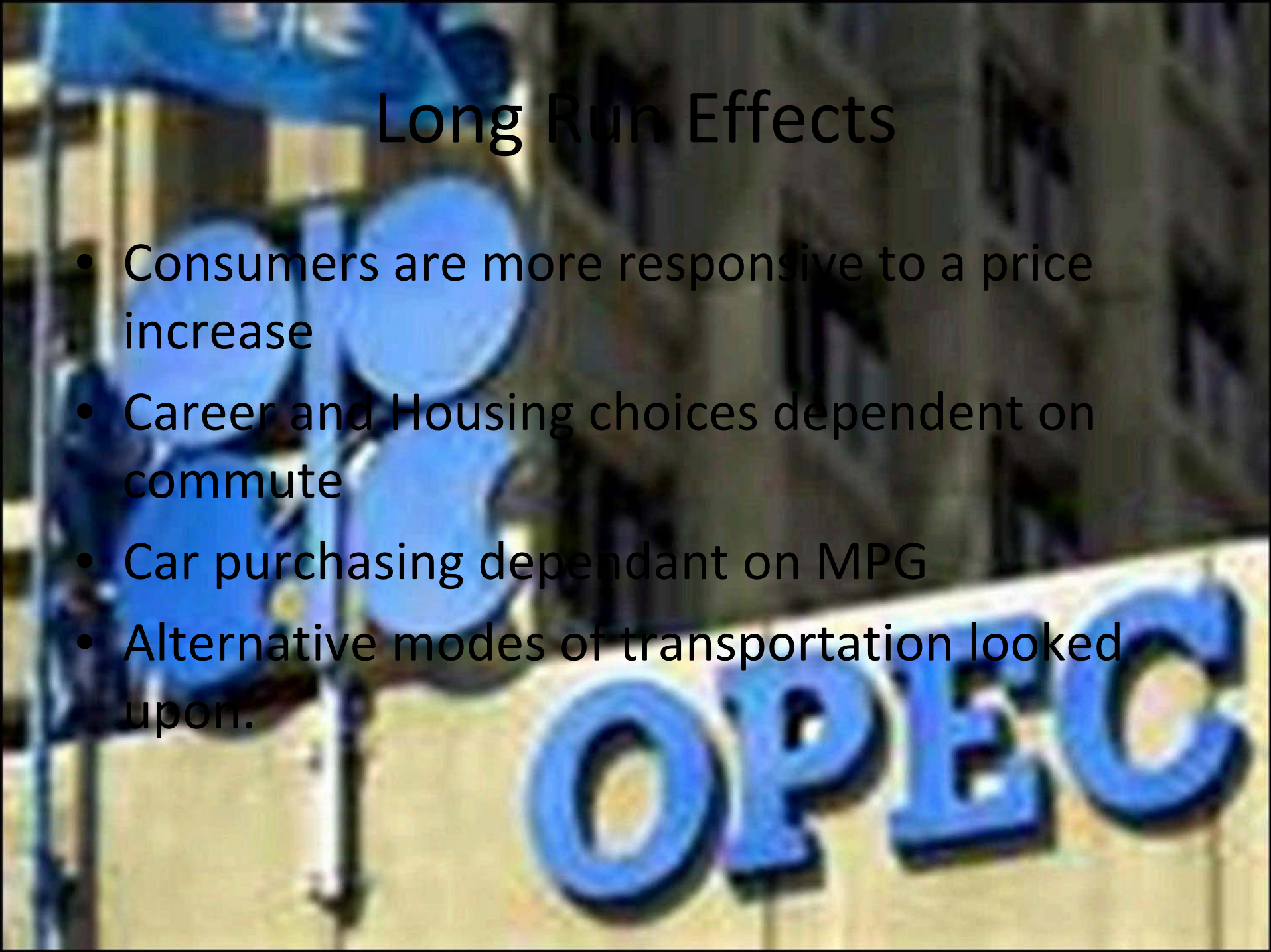
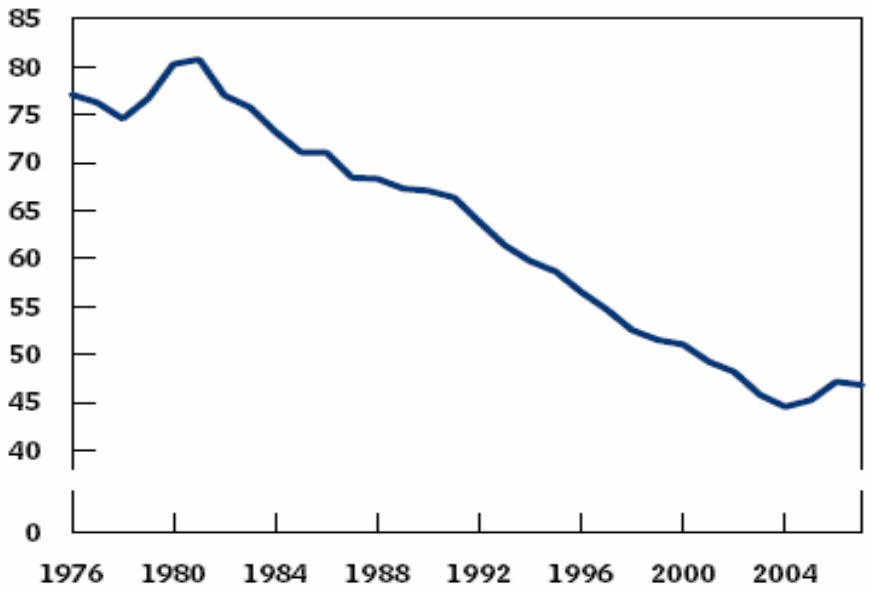


Figure 2-1.

Market Share of Cars versus Light Trucks, 1976 to 2007

(Percent, new passenger vehicle sales)



Source: Congressional Budget Office based on data from the Bureau of Economic Analysis.

Table 2-2.

Estimated Effect of a 20 Percent Increase in the Price of Gasoline on U.S. Market Shares of New Passenger Vehicles

(Percent)

	Average Market Share[a]	Average Effect of Increase (Percentage points)[b]	Statistical Significance	Relative Change In Market Share[c]
Cars (Versus light trucks)	46.4	+2.6	**	+5.6
Cars				
Subcompact or two-seater	1.4	+0.1	*	+6.8
Compact	19.7	+0.9	*	+4.5
Midsize	16.6	+0.8	*	+5.0
Large	8.7	+0.8	**	+9.4
Light Trucks				
Minivan	6.2	-0.3	*	-5.0
SUV	26.9	-1.2	**	-4.5
Pickup truck	18.2	-1.0	*	-5.7
Passenger or cargo van	2.3	-0.1	b	-3.9
Total Cars and Light Trucks	**100**	**0**	n.a	n.a.

Source: Congressional Budget Office based on vehicle sales data from *Automotive News* and gasoline price data from the Department of Energy, Energy Information Administration.

Note: ** = significant at 1 percent; * = significant at 5 percent; SUV = sport–utility vehicle; n.a. = not applicable.

a. Market share averages are not sales weighted.

b. Over all vehicle categories, the net change in market share must be zero. Thus, a value of -0.1 for the market share of "passenger or cargo van" is not estimated directly but is derived from changes in the market shares of other vehicles.

c. Percentage increase in market share given in first column when percentage points in second column are added to it.

Conclusion

How does all the information come together?

- Non – Transportation
  - Primarily environmental impact
- Transportation
  - Significant reduction but susceptible to OPEC
- New Resource Discoveries
  - Downfall of the cartel

References

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