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Energy Security, Climate and Your Car: U.S. Energy Policy and Beyond

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Geopolitics, not Geology, is driving the energy future





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Bottom Line of the Energy Security Issue

Geopolitics is driving our energy future.

There are many reasons to be concerned about a major supply disruption that could affect mobility.

The restructuring of the oil industry means that we are going to be more dependent on national oil companies to produce future energy supply.

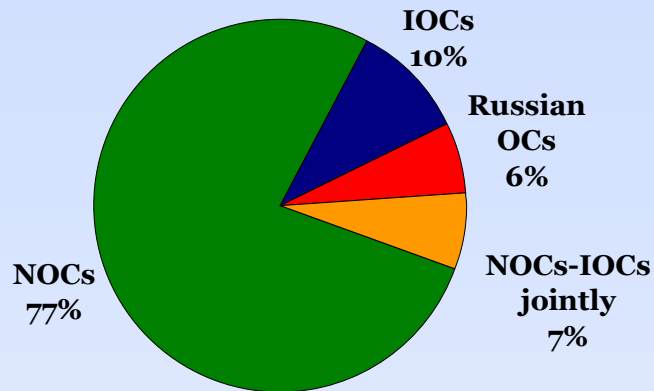
Longer term, given this restructuring, the future oil supply may fail to materialize in the volumes we expect and need.

There exists a vast pent up demand for automobiles and electricity in the developing world.



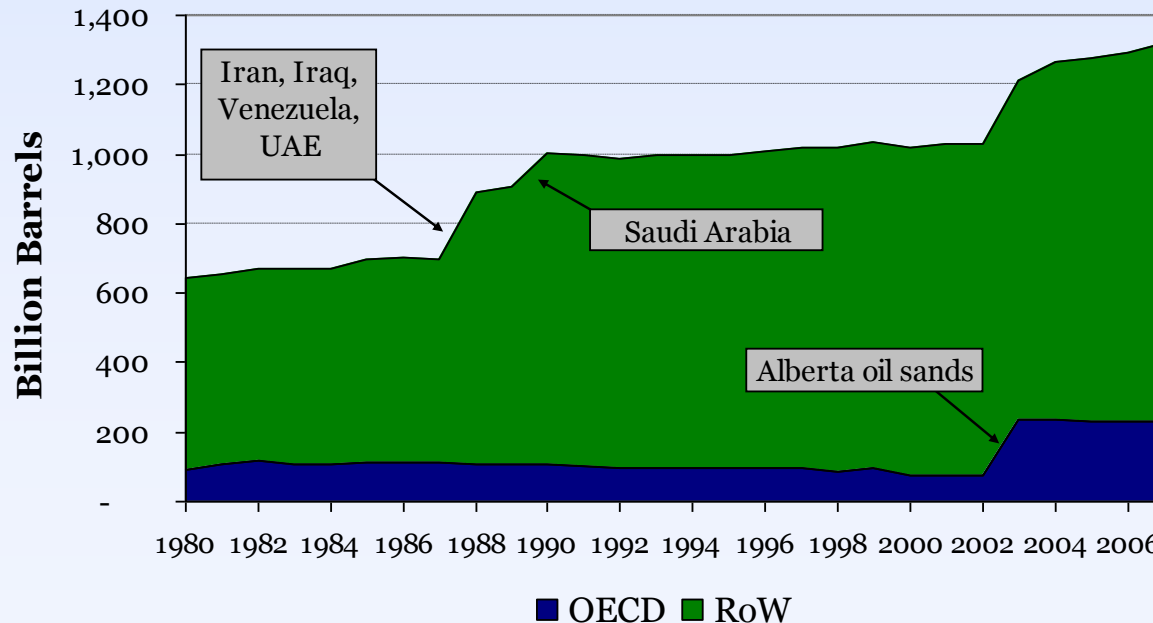
Control of World Oil Reserves

Control of Oil Reserves, 2005



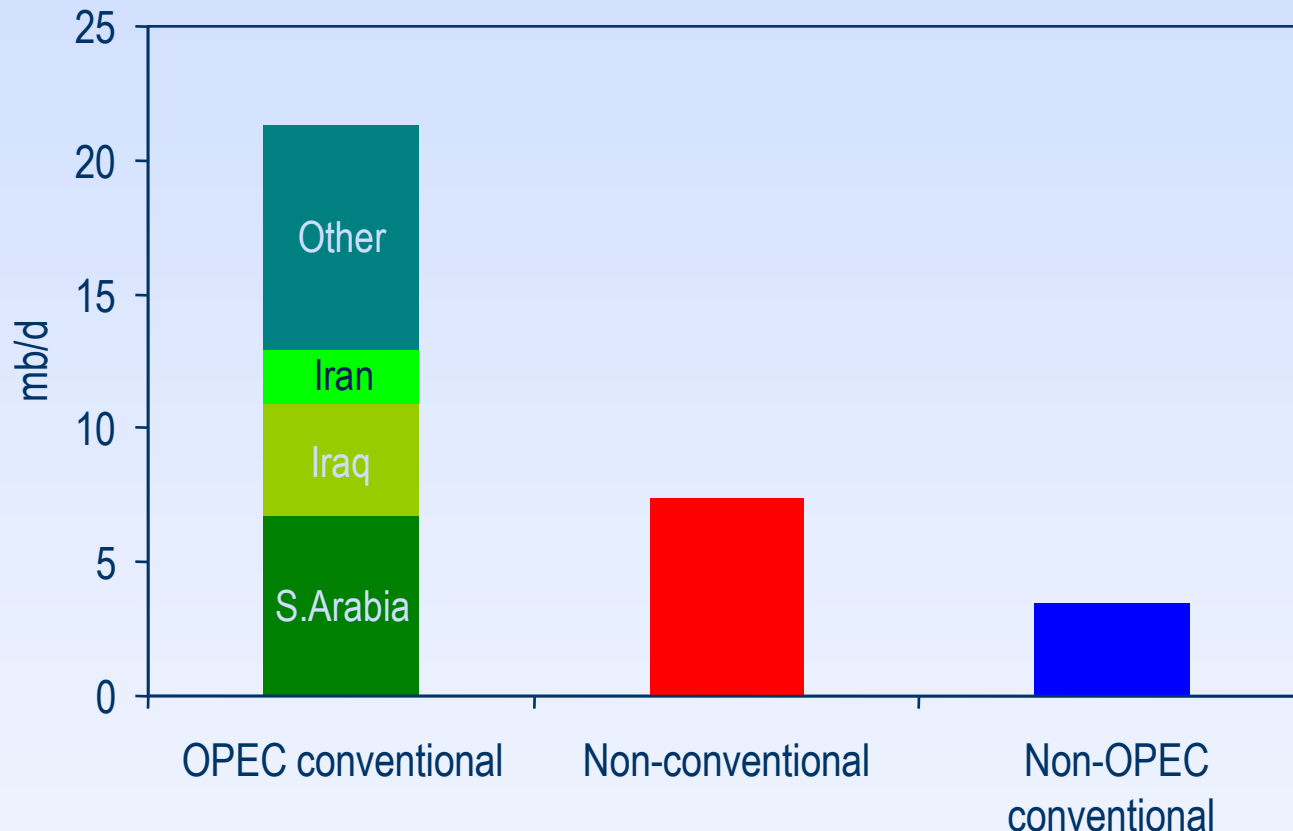
Majority of remaining oil resources are controlled by traditional state monopolies and emerging partially privatized firms.

World Proved Crude Oil Reserves, 1980-2006





IEA Base Case Reference Scenario: Increase in World Oil Supply, 2004-2030



Under a business as usual scenario, world will increasingly rely on Persian Gulf and unconventional oil, including about 3.5 to 4 million b/d of Canadian tar sands production, 1.5 to 2 mb/d of upgraded heavy oil, 2.4 mb/d of gas to liquids and 1.7 mb/d of coal to liquids, oil shale, etc



Bottom Line of the Energy Security Issue

High Risk of Major Short Term
Disruption



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Bottom Line of the Climate Issue

Emissions from Unconventional
Oil is Very Small Compared to
Natural Gas Flaring, Gasoline
Fuel Emissions, and Coal Use



Political Transition: Shiism vs Sunni Mainstream, Might a Conflict Erupt?

“The real danger is in the division that is being projected between the Arabs of Iraq, dividing them into Shias and Sunnis, especially a separate entity for both...this is a recipe for bringing the countries around Iraq into conflict themselves. You have Iran on one side which will come in with the Shias. We have the Turks on the other side who will come in to fight with the Kurds, and the Arabs will definitely be dragged into the fight on the part of the Sunnis.”

“Several years ago, we fought a war with the United States and Saudi Arabia in order to save Iraq from the occupation of Iran. Now it seems that Iran is being handed Iraq on a golden platter. So this is something that the U.S. must think about. Unless the Sunnis and Shias are brought together in a majority government to hold the country together, it will disintegrate into civil war. And then, the whole region will also disintegrate and conflicts that we have not dreamt of in the past will be facing the international community.”

--HRH Prince Saud Al Faisal Bin Abdulaziz Al-Saud, Saudi Foreign Minister at the Baker Institute on September 21, 2005



Political Transition: Shiism vs Sunni Mainstream, Might a Conflict Erupt?

“The public demand in Bahrain is the reunification of this province to its motherland, the Islamic Republic of Iran,” said Hussain Shariatmadari, an advisor to Iranian Supreme Leader Ali Khamenei and managing editor of the Iranian daily Kayhan. “It goes without saying that such an indisputable right for Iran and the people of this province should not and cannot be overlooked.” Bahrain, he added, was separated from Iran “through an illicit conformity between the former Shah and the governments of Britain and the United States.”



Saudi Arabia

From Osama Bin Laden's Letter to the
American People:

***“You steal our wealth and oil at paltry prices
because of your international influence and
military threats. This theft is indeed the
biggest theft ever witnessed by mankind in
the history of the world.”***

--Osama Bin Laden

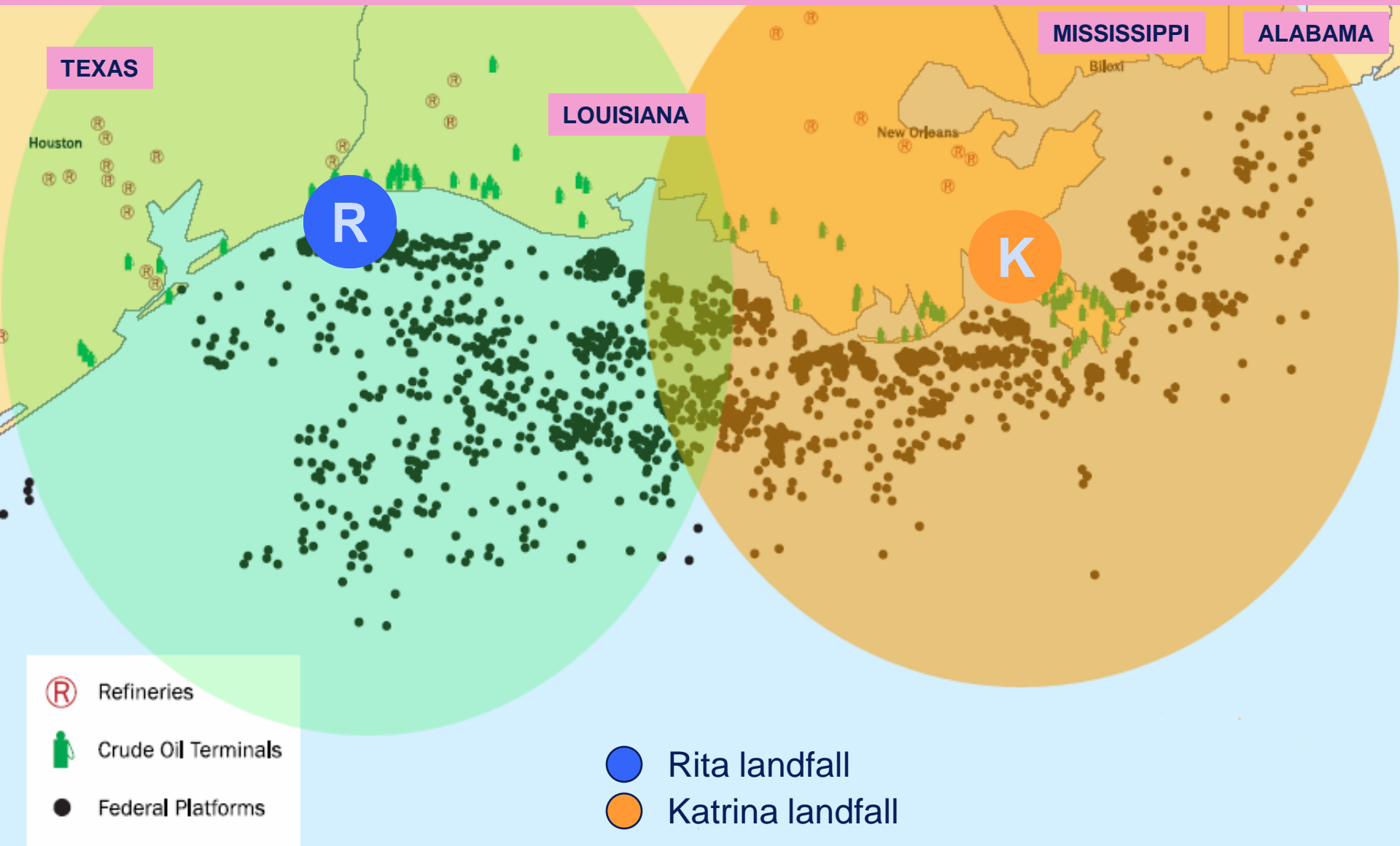
In December 2004, called on the faithful to attack oil facilities as
part of the jihad against the West



Oil Crises and Petroleum Security

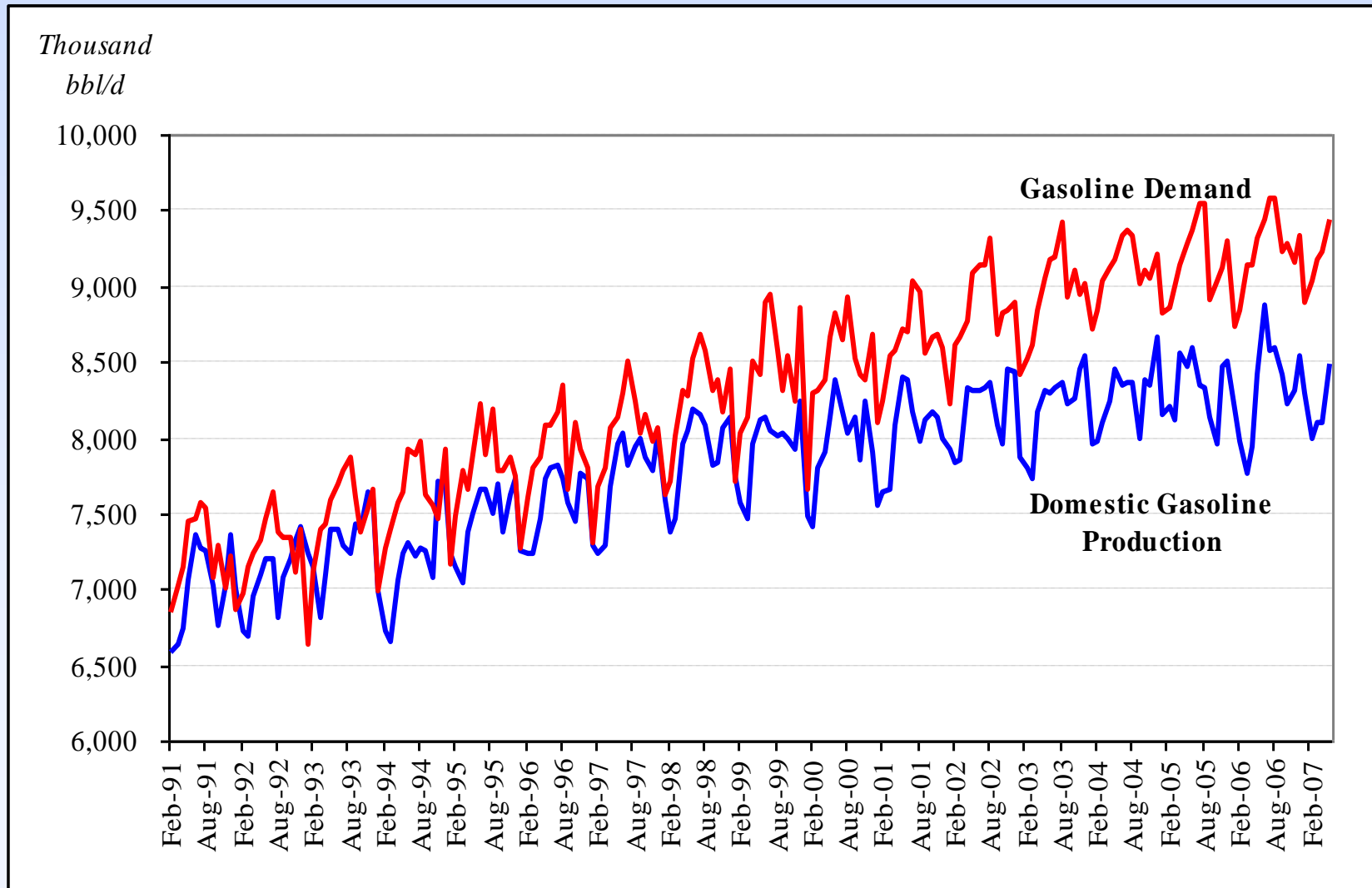
	October 1973	August 1990	September 2005
Reason for Crisis	<ul style="list-style-type: none"> - Fourth Middle East war - Embargo by Arab oil producers 	<ul style="list-style-type: none"> - Iraq invades Kuwait 	<ul style="list-style-type: none"> - Hurricane Katrina
Supply decrease period	6 months	7 months	3 to 6 months
Supply decrease magnitude	<ul style="list-style-type: none"> - 4.3-4.5 million b/d (2 months) - 2.2-2.6 million b/d (2 months) 	<ul style="list-style-type: none"> - 5.0-5.3 million b/d (2 months) - 4.0-4.7 million b/d (3 months) 	<ul style="list-style-type: none"> - 1.4-1.5 million b/d (initially) - 900,000 b/d (9 days)
Excess production capabilities	~ 3.75 million b/d	~ 6.20 million b/d	~ 0.9-1.4 million b/d
No. of days of petroleum stocks in OECD	Public – 0 Private – 70 days	Public – 25 days Private – 61 days	Public – 31 days Private – 54 days
Petroleum market structure	<ul style="list-style-type: none"> - Majors posting price system 	<ul style="list-style-type: none"> - Market-linked pricing system - Active oil futures market 	<ul style="list-style-type: none"> - Market-linked pricing system - Active oil futures market

Hurricanes Rita, Katrina And Gulf Oil & Natural Gas Operations



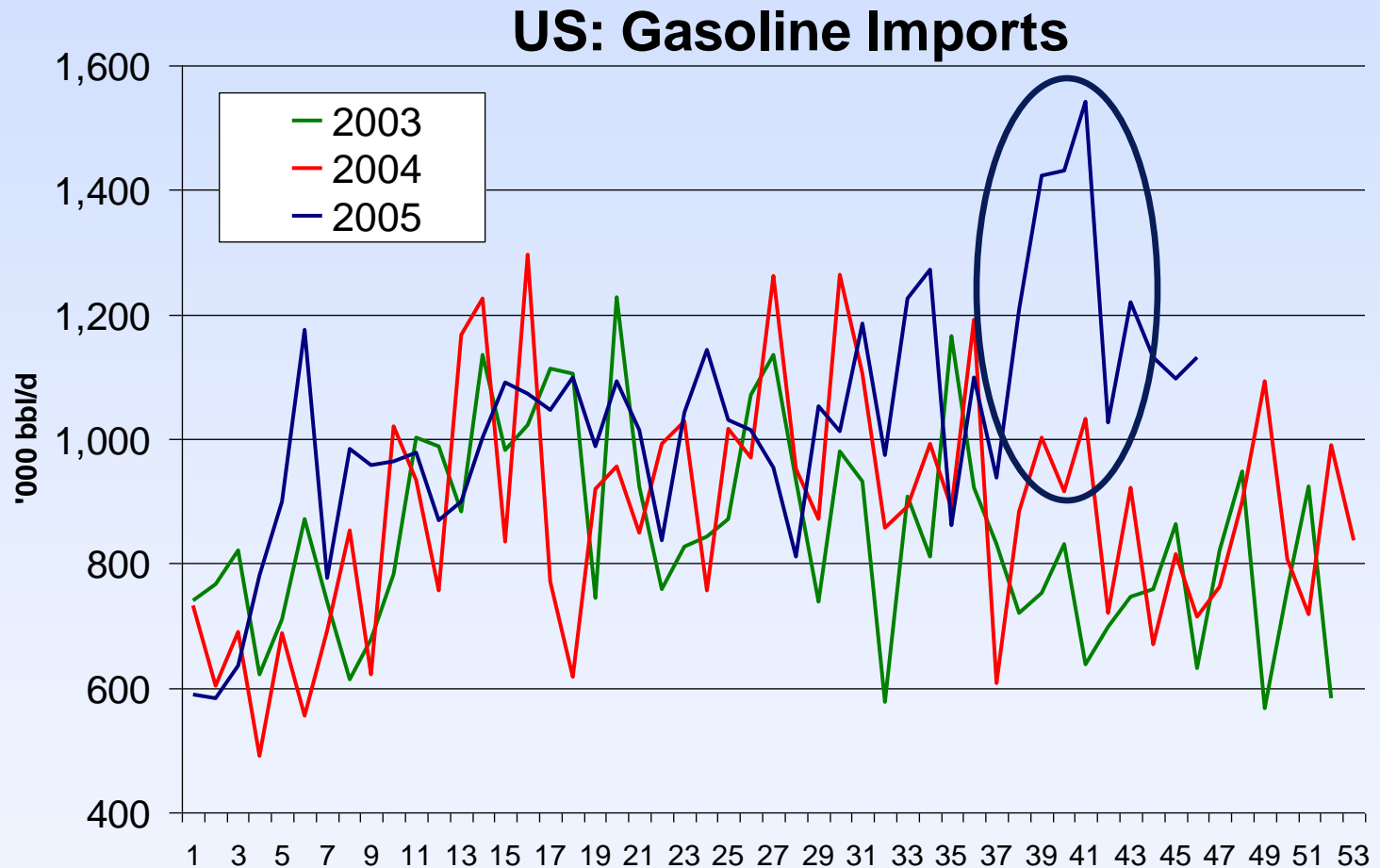


U.S. Becoming More Reliant on Gasoline Imports





Government Policy Response to Katrina: Facilitate Imports To Fill in the Gap





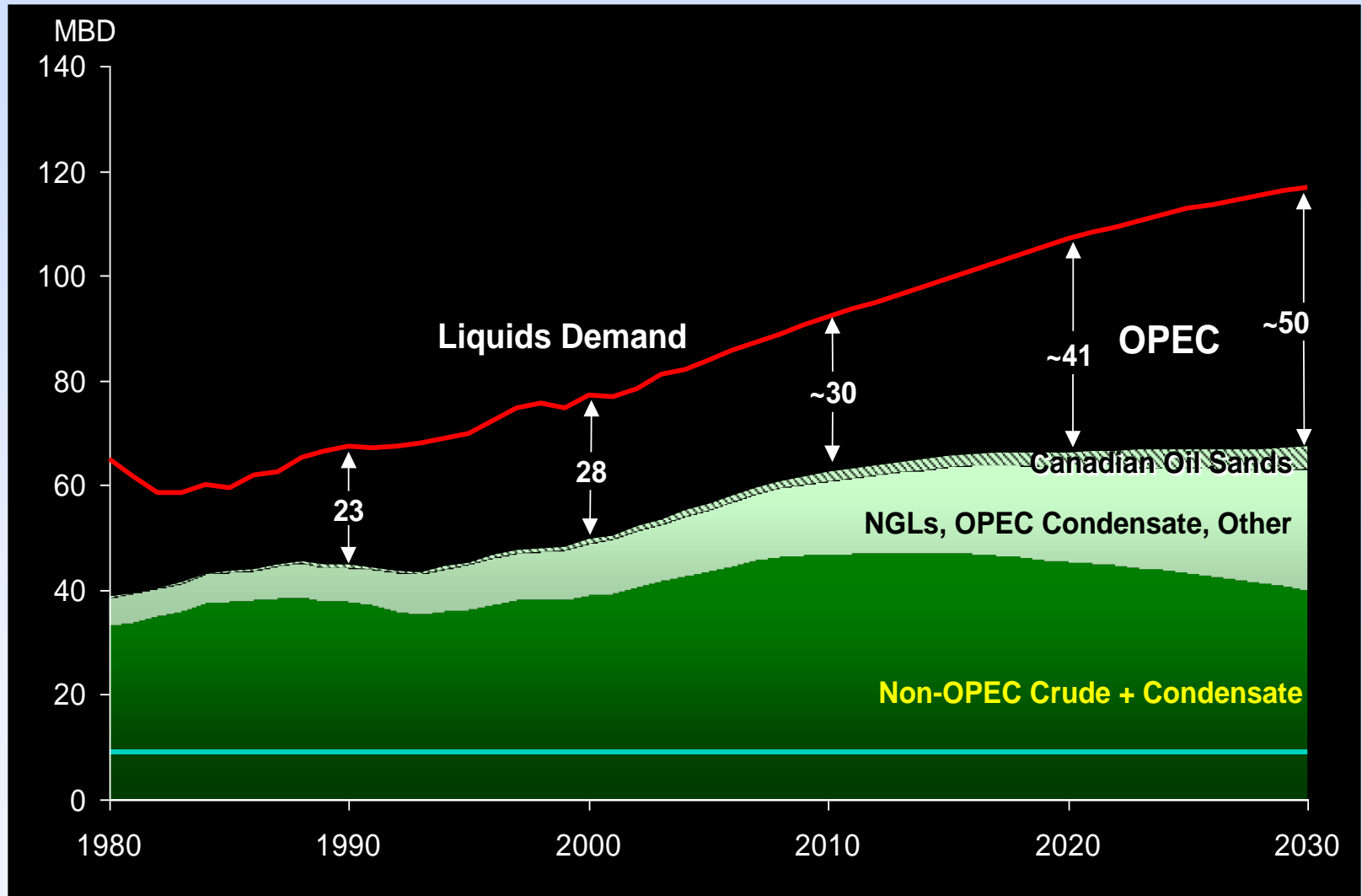
Bottom Line of the Energy Security Issue

High Risk of a Long Term
Structural Problem



World Liquids Production Outlook

Source: ExxonMobil





OPEC capacity has fallen, not increased, since 1979

OPEC Production and Spare Capacity, 1979-2003 (mmbbl/d)

Member Country	1979	1983	1990	1997	1998	2000	2001	2003	2005
Saudi Arabia	10.84	11.30	8.00	9.65	9.80	9.50	9.90	10.15	10.30
Iran	7.00	3.00	3.10	3.70	3.70	3.75	3.80	3.80	4.00
Iraq	4.00	1.50	3.60	2.30	2.80	2.90	3.05	2.20	1.80
Kuwait	3.34	2.80	2.40	2.40	2.40	2.40	2.40	2.50	2.60
UAE	2.50	2.90	2.20	2.40	2.40	2.40	2.45	2.50	2.40
Qatar	0.65	0.65	0.40	0.71	0.72	0.73	0.75	0.75	0.82
Venezuela	2.40	2.50	2.60	3.45	3.30	2.98	3.10	2.50	2.50
Nigeria	2.50	2.40	1.80	2.00	2.05	2.10	2.30	2.30	2.30
Indonesia	1.80	1.60	1.25	1.40	1.35	1.35	1.30	1.15	0.90
Libya	2.50	2.00	1.50	1.45	1.45	1.45	1.45	1.45	1.60
Algeria	1.23	1.10	0.75	0.88	0.88	0.88	0.88	1.15	1.35
Total	38.76	31.75	27.60	30.34	30.85	30.44	31.38	30.45	30.57
Call on OPEC	34.01	16.65	22.20	27.59	25.85	30.04	28.23	29.20	29.87
Spare Capacity	4.75	15.10	5.40	2.75	5.00	0.40	3.15	1.25	0.70

Opec can replace all Iraqi/Kuwait oil in 1990 →
 Asian economic crisis leaves extra capacity in 1998 →
 Demand bumps up against capacity



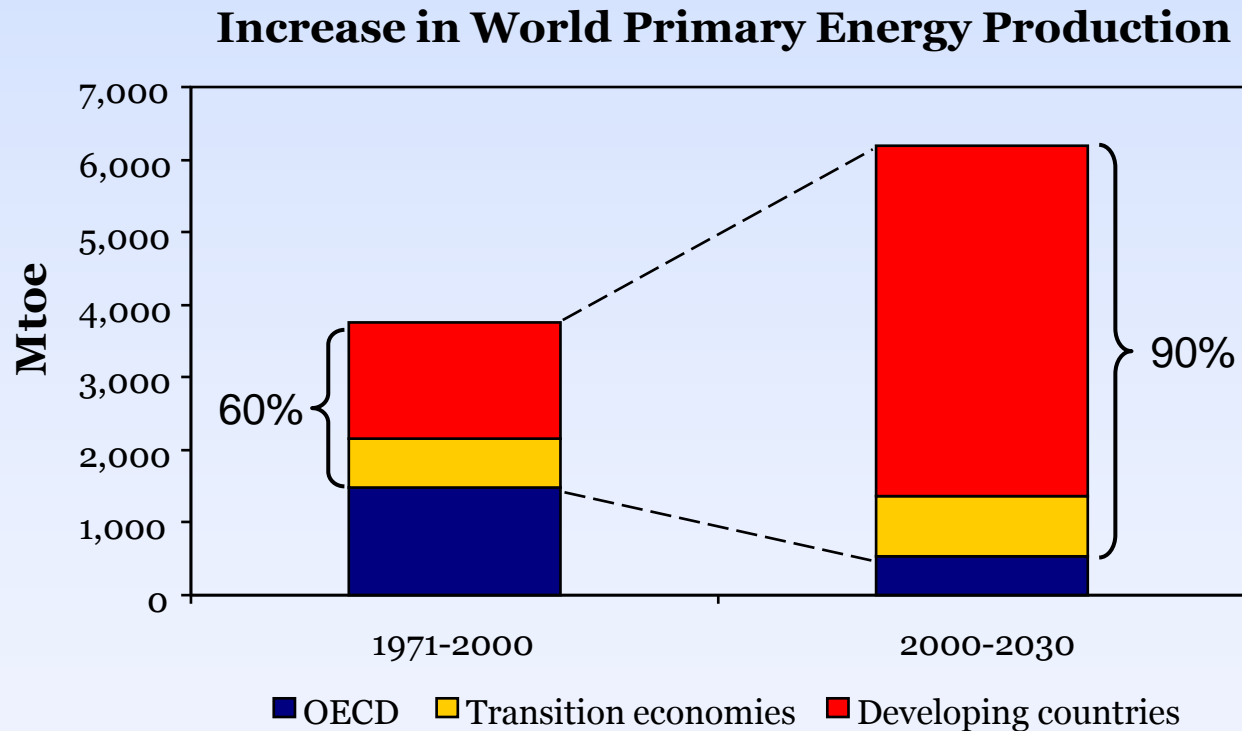
Summary of Key Findings and Conclusions: NOC Objectives

- NOCs have important national goals that go beyond the maximization of return on capital to shareholders.
- These include:
 - ◆ Oil wealth redistribution to society at large,
 - ◆ Wealth creation for the nation,
 - ◆ Industrialization and economic development,
 - ◆ Energy security, including assurance of domestic fuel supply and security of demand for producing nations,
 - ◆ Foreign and strategic policy and alliance building, and
 - ◆ Participation in national level politics.



NOCs Gaining Increasing Control of Future Energy Production

- The IEA projects that the OECD will supply just 10% of the increase in world primary energy supply in the next 3 decades, as compared to 40% over the last 3 decades.



Source: International Energy Agency, *World Energy Outlook 2002*

90% of new primary energy production is projected to come from transitioning and developing economies, up from 60% in previous 3 decades.



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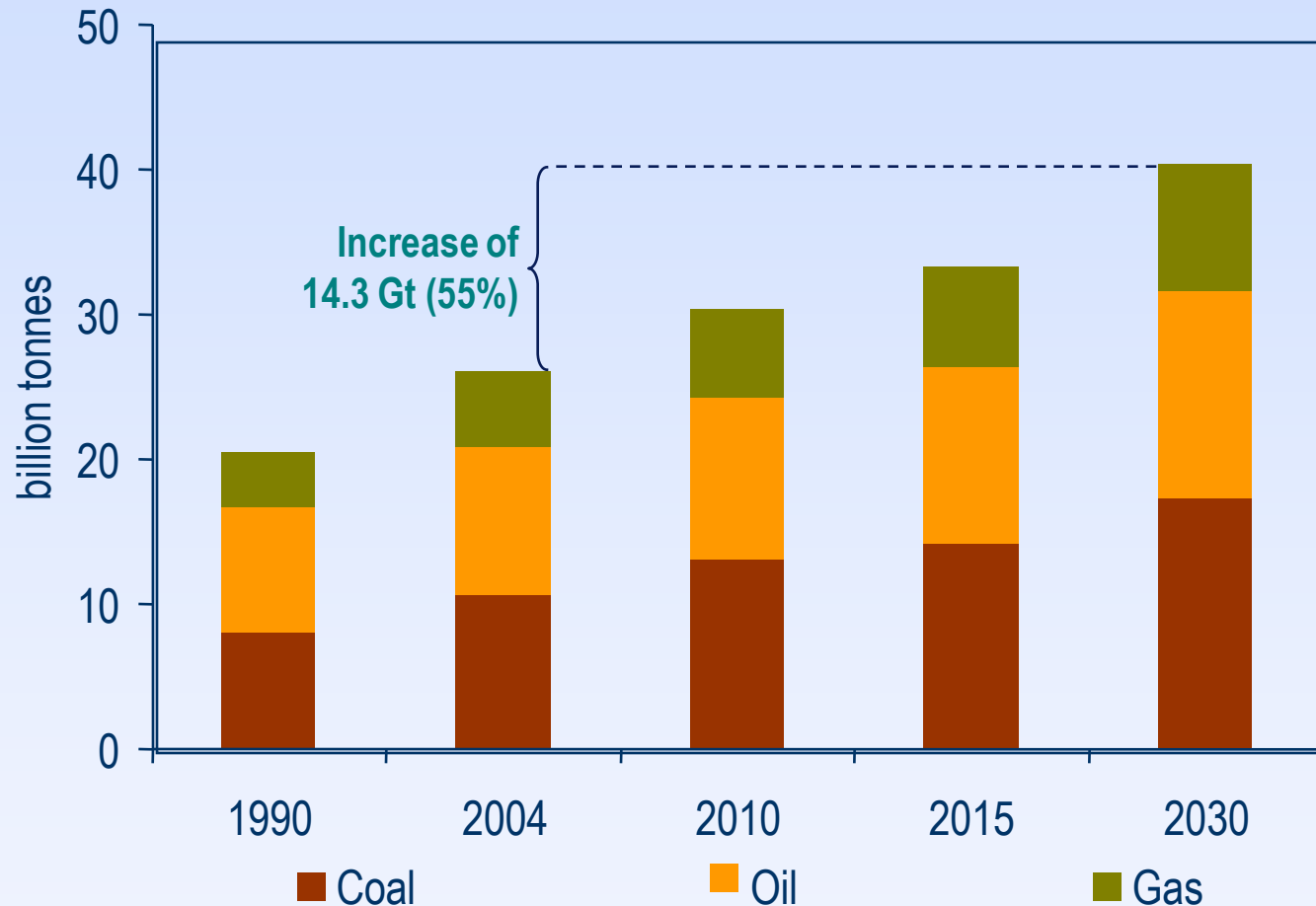
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Bottom Line of the Climate Issue

Emissions from Unconventional
Oil is a Small Part of the
Problem and Could be
Reduced; Flaring is a Larger
Concern as is Coal Use and
Gasoline Fuel Emissions



IEA Base Case Reference Scenario: Implications for CO₂ Emissions



Half of the projected increase in emissions comes from new power stations, mainly using coal & mainly located in China & India; contribution of emissions from unconvensionals is less significant—accounting for less than 0.3% of global emissions

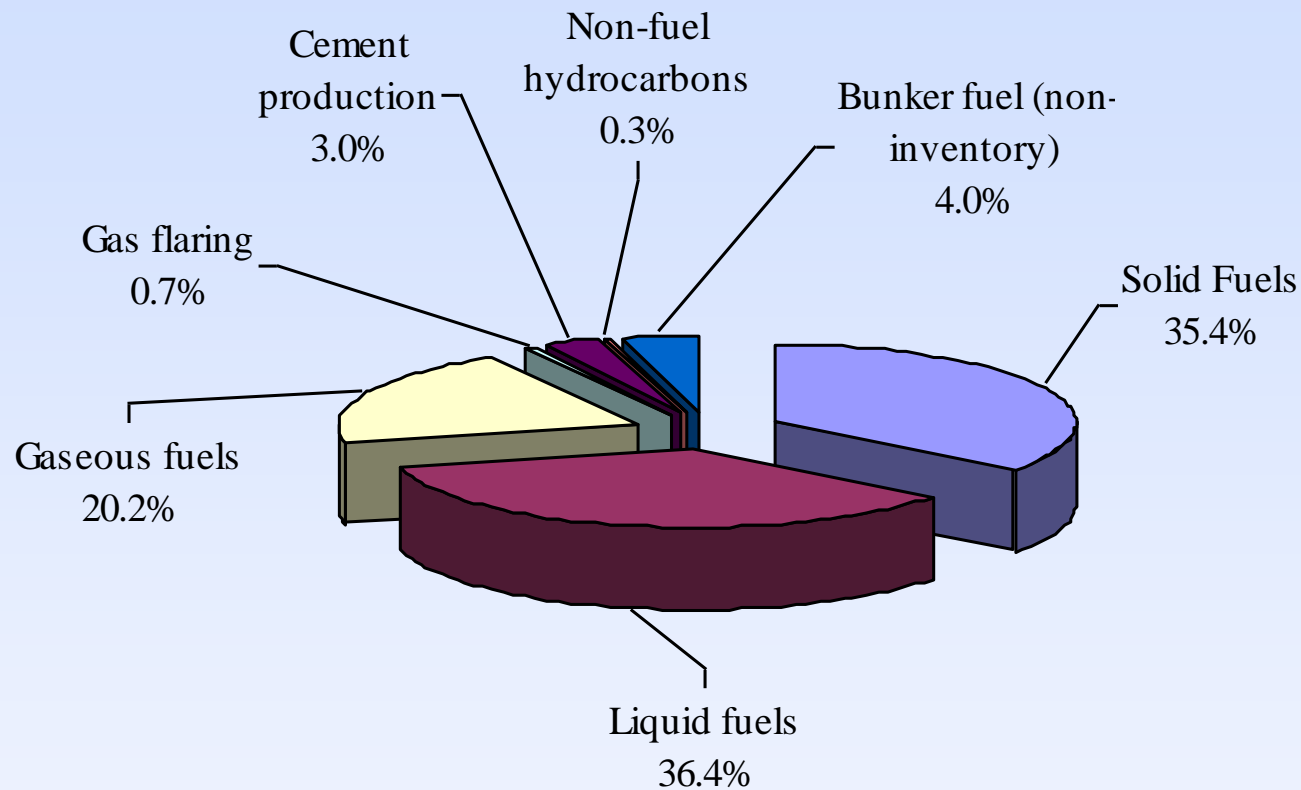


Source for Fossil Fuel Emissions Facts

- Reducing the Carbon from American corporate practice –What should the priority target be?
 - ◆ Tar Sands production results in 0.09 to 0.16 tons of carbon per barrel while total emissions from tar sands at 1 million b/d of production is about 167 million tons per year.
 - ◆ GHG emissions from flaring of natural gas is about 400 million tons per year, over three times the level of tar sands total annual emissions and also poses an immediate health risk to local populations. Flaring represents the same scale as emissions from all vehicles in the UK, France and Germany, for example. The leading contributors to gas flaring are: Nigeria, Russia, Iran, Algeria, Mexico, Venezuela, Indonesia and the United States.
 - ◆ Gasoline use contributes about a third of all emissions stemming from fossil fuel combustion



Sources of CO₂ (2000-2005)



Source: EIA



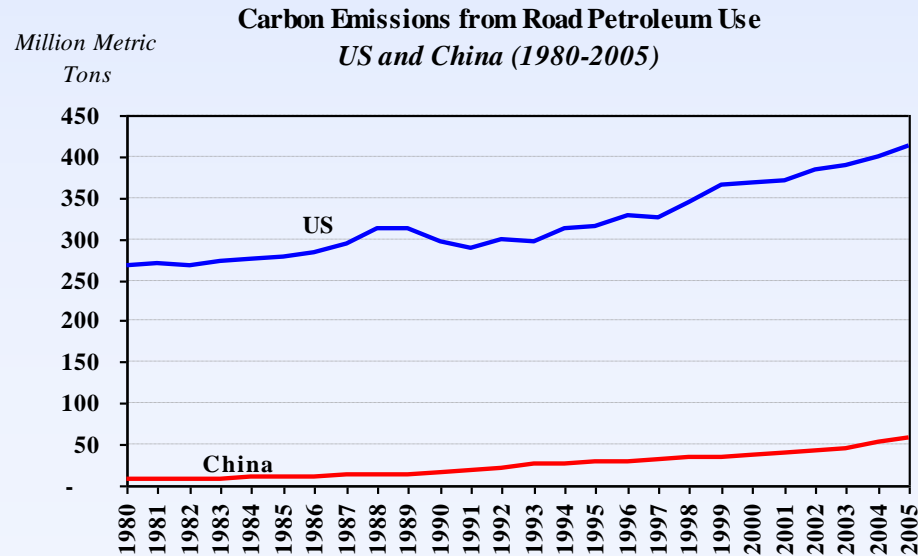
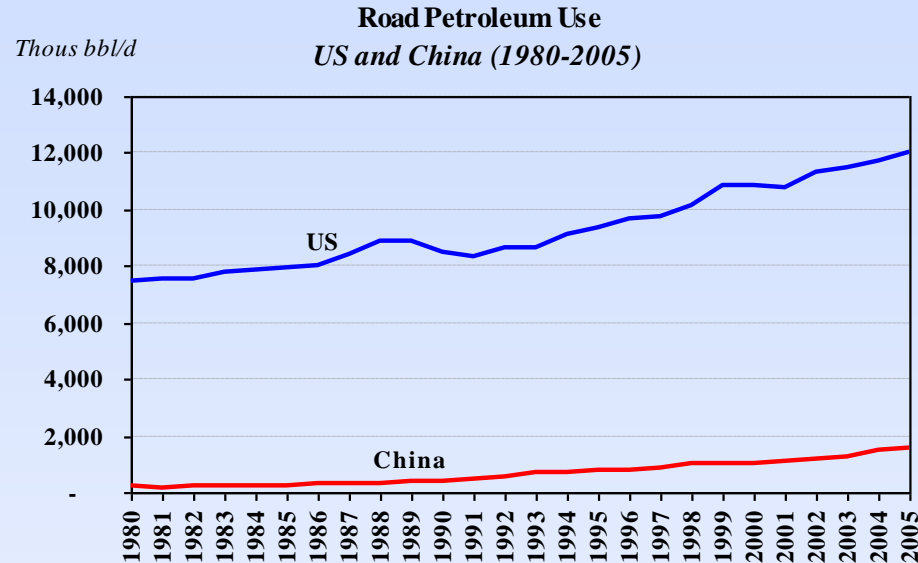
Bottom Line of the Energy Security Issue

Future Growth in Oil Use Will
Focus Almost Entirely in the
Transportation Sector: We Need
to Address the Efficiency Issue in
Vehicles



U.S. Gasoline Facts

■ U.S. vs China (in pictures)

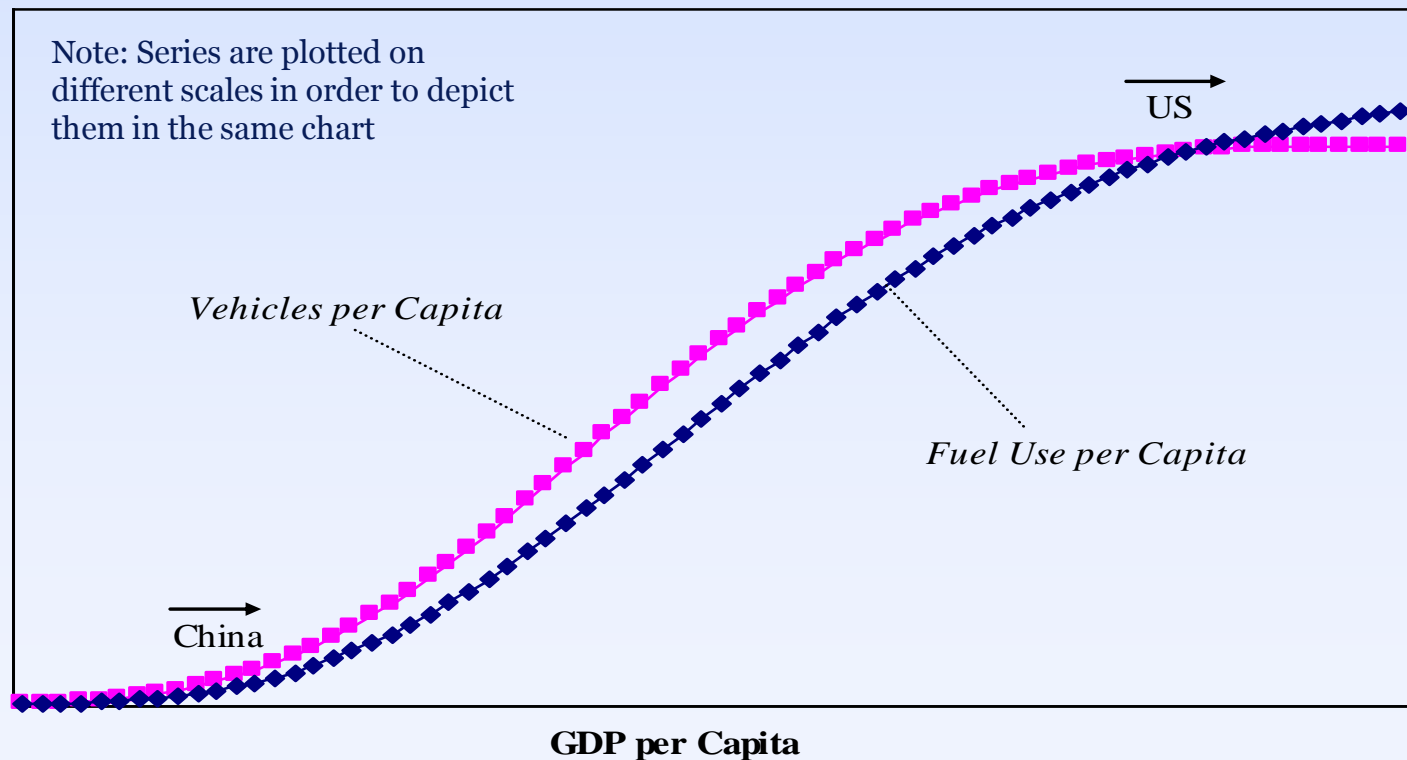




Transportation Energy Use, Vehicle Stocks, and Economic Development

- Countries such as China are at the “launching” point. So, we should expect vehicle stocks and transportation fuel use to grow very rapidly in those countries as they continue to develop.

"Average" Country Simulation of Patterns





U.S. Gasoline Facts

■ U.S. Policy Options - Demand

- ◆ To hold U.S. gasoline use at 2005 levels by 2017, on-road efficiency must rise to 22 mpg, about 25% higher than today. At a turnover rate of 20% of cars in 10 years, all *new* cars would need to get roughly 42 mpg. At an accelerated turnover rate of 50% in 10 years, all *new* cars would need to get 26.5 mpg.
- ◆ To hold U.S. gasoline use at 2005 levels by 2017 through conservation, we would have to drive about 45 miles less per vehicle per week by 2017.
- ◆ To hold U.S. gasoline demand flat between 2005 and 2017 through an aggressive ethanol program, U.S. ethanol production would have to increase by 7 times, or an increase of 17 % per year for 10 years.



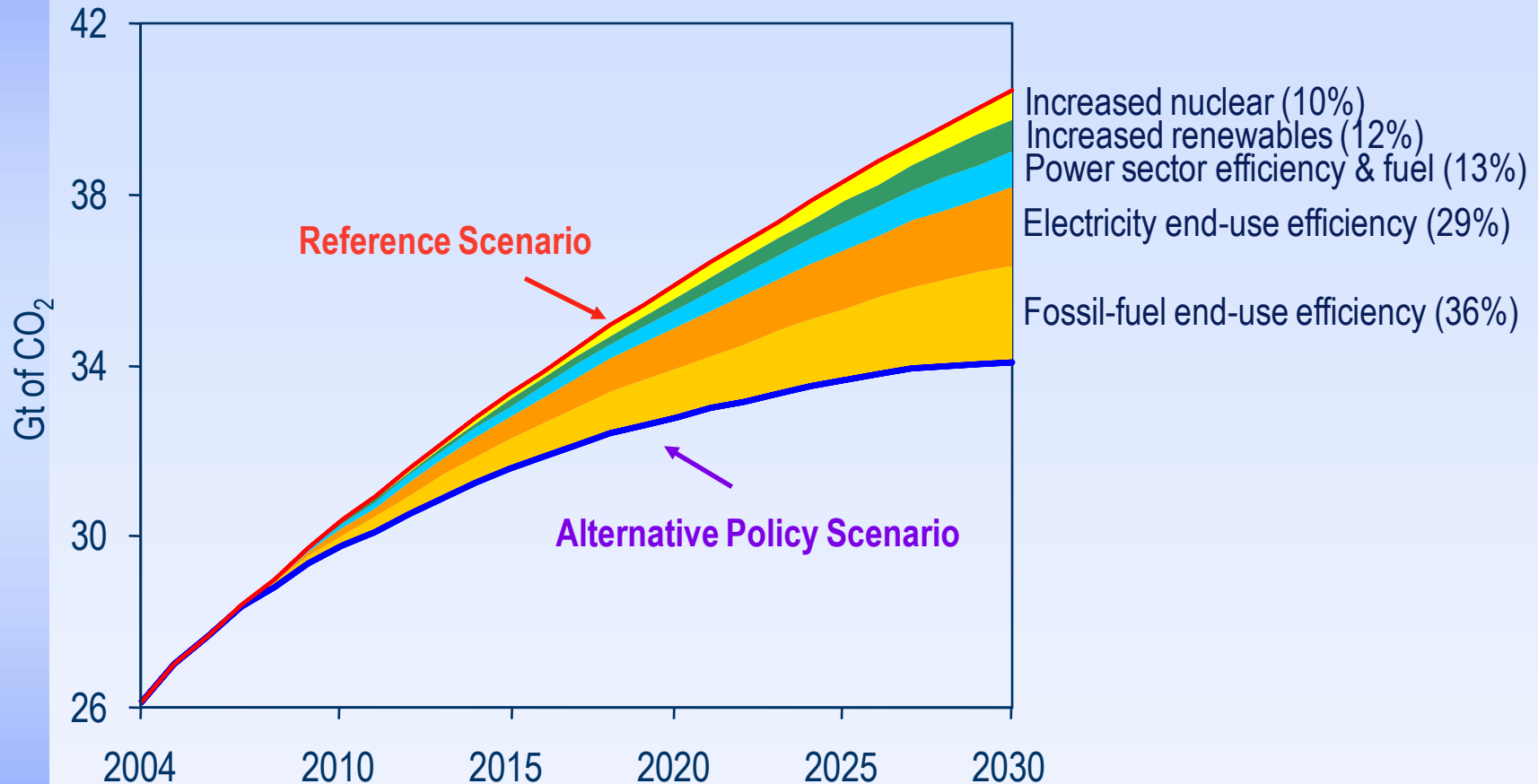
U.S. Gasoline Facts

■ U.S. Policy Options - Carbon

- ◆ An improvement in *on-road* efficiency of 1 additional mpg per vehicle would save 600,000 b/d of oil and reduce carbon emissions by about 5%
- ◆ Doubling *on-road* vehicle efficiency to 35 mpg by 2030 would reduce U.S. transportation oil use by about 1.4 mb/d compared to current consumption, and reduce carbon emissions from by almost 100 million metric tons per year.
- ◆ Even so, it will be hard to reduce carbon emissions to the scales necessary via car efficiency along.
- ◆ It will take a combination of policies to reduce emissions in the transportation sector, including public transportation, alternative energy technology and conservation/lifestyle changes.



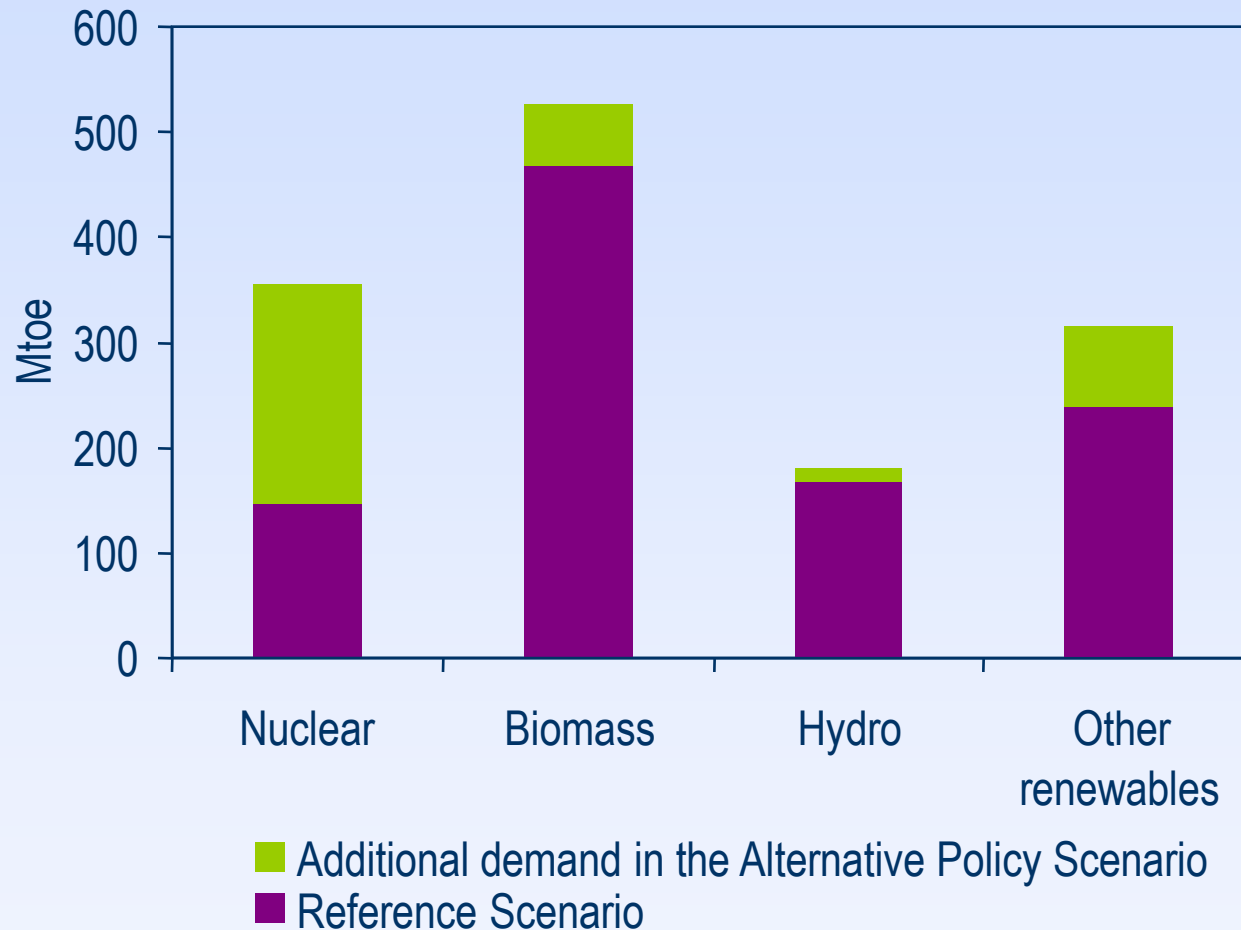
IEA's Projections for Global Savings in Energy-Related CO₂ Emissions If Aggressive Policy Response Undertaken



Improved end-use efficiency of electricity & fossil fuels accounts for two-thirds of avoided emissions in 2030



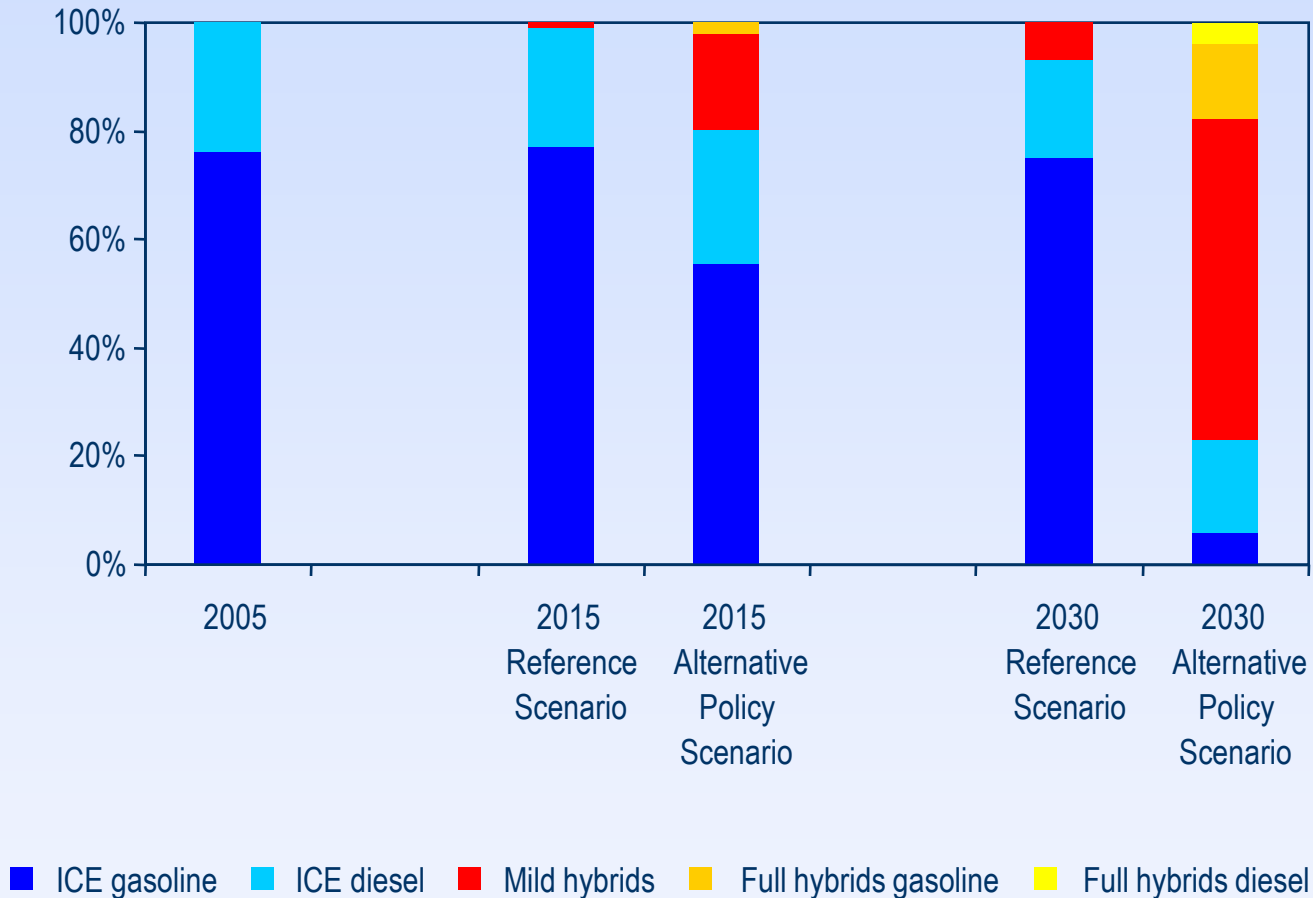
Specifics of Increase in non-Fossil energy under this scenario 2004-2030



Demand for non-fossil energy – nuclear power & renewables – is 11% higher in 2030 than in the Reference Scenario thanks to stronger policies



What Would We Drive Under an Aggressive Policy Scenario?



Mild hybrids represent 60% of global new light-duty vehicle sales in 2030, up from 7% in the Reference Scenario



Alternative Energy Potential?

- *The hydrogen myth ---conversion losses, source problem, storage problem, safety issues
- *Biofuels –builds on existing infrastructure and backed by large players; scale up factors, quality control/specifications and logistics still a question
- *Carbon sequestration technologies
- *Solar –so much potential, few big players –Enter the “Governator”
- *Batteries/Plug in cars -Note: *at \$3.00 a gallon gasoline and 9.45 cents per kWh electricity, operation of an electric fuel would be 2.2 cents a mile vs 17 cents a mile for a car getting 17.3 mpg*

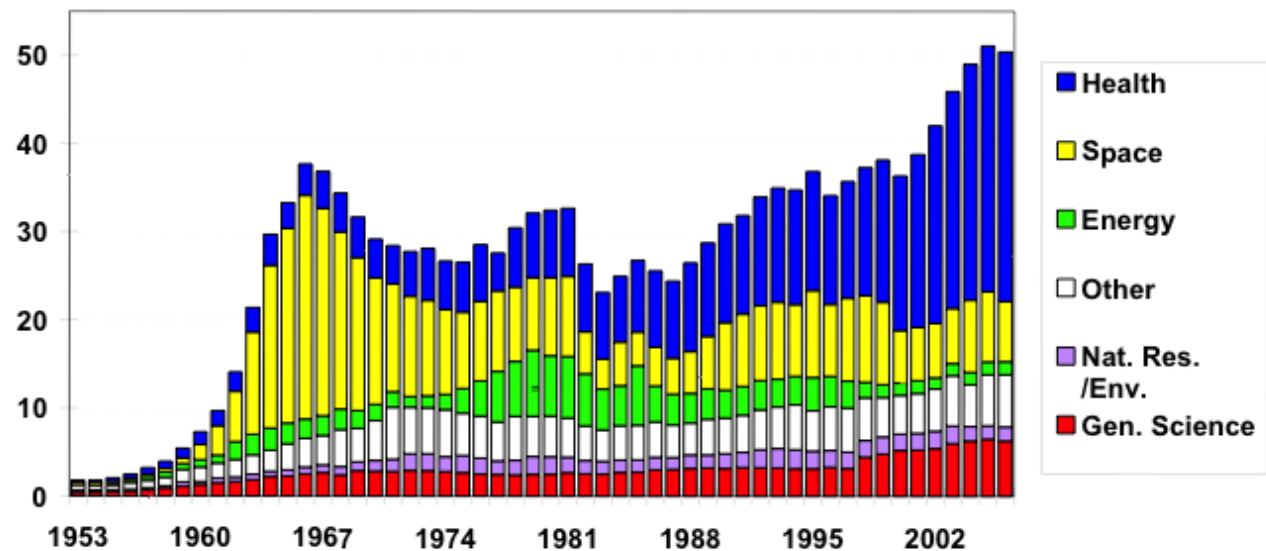
Ultimately, new policy frameworks will be needed to remove obstacles and provide incentives. Even with intervention, however, it will take a long time for alternative energy to reach critical mass.



Hillary Clinton and the Apollo Approach: Spending on Energy Science has collapsed since 1973

Trends in Nondefense R&D by Function, FY 1953-2006

outlays for the conduct of R&D, billions of constant FY 2005 dollars



Source: AAAS, based on OMB Historical Tables in *Budget of the United States Government FY 2006*. Constant dollar conversions based on GDP deflators. FY 2006 is the President's request.

Note: Some Energy programs shifted to General Science beginning in FY 1998.
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