



Strategic Advisors in Global Energy

# **Policies and Technology in the Transportation Sector**

**Third OPEC International Seminar  
Vienna, Austria  
September 13, 2006**



**Robin West, Chairman  
PFC Energy**

Version 9/1/06

## **Purpose of today's remarks – provide a policy perspective on transportation technology**

1. Brief PFC Energy outlook for oil supply and demand
2. Role of policy and technology in the transportation sector
3. The U.S. experience in transportation policy
4. Brief overview of alternative transportation technology and fuels
5. The challenge of innovation
6. Policy conclusions

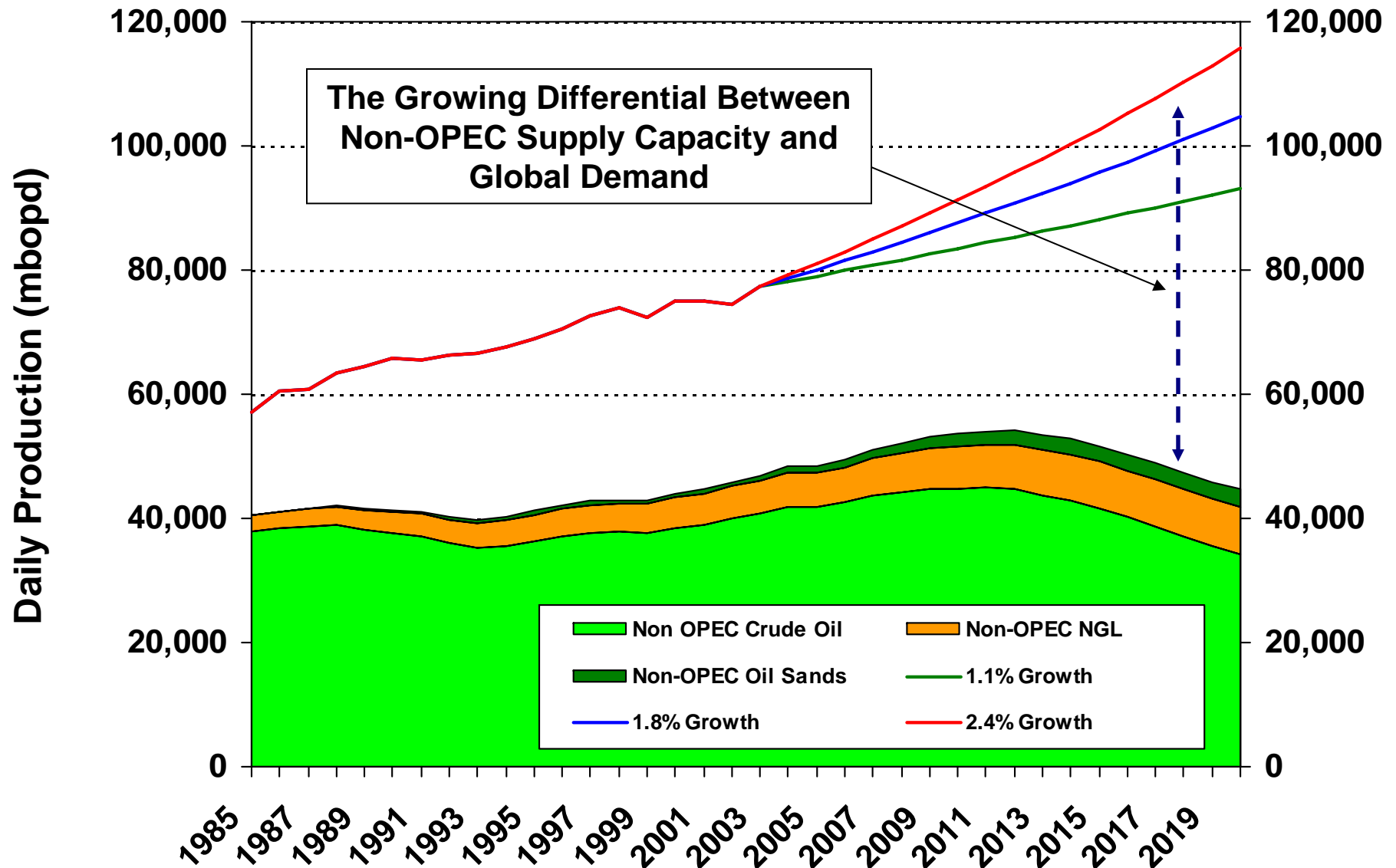
# Key Messages

---



- **Given existing technology, oil production capacity will struggle to meet world demand**
  
- **Policies and technologies in the transportation sector – a large and growing component of demand – are crucial to balancing our energy future**

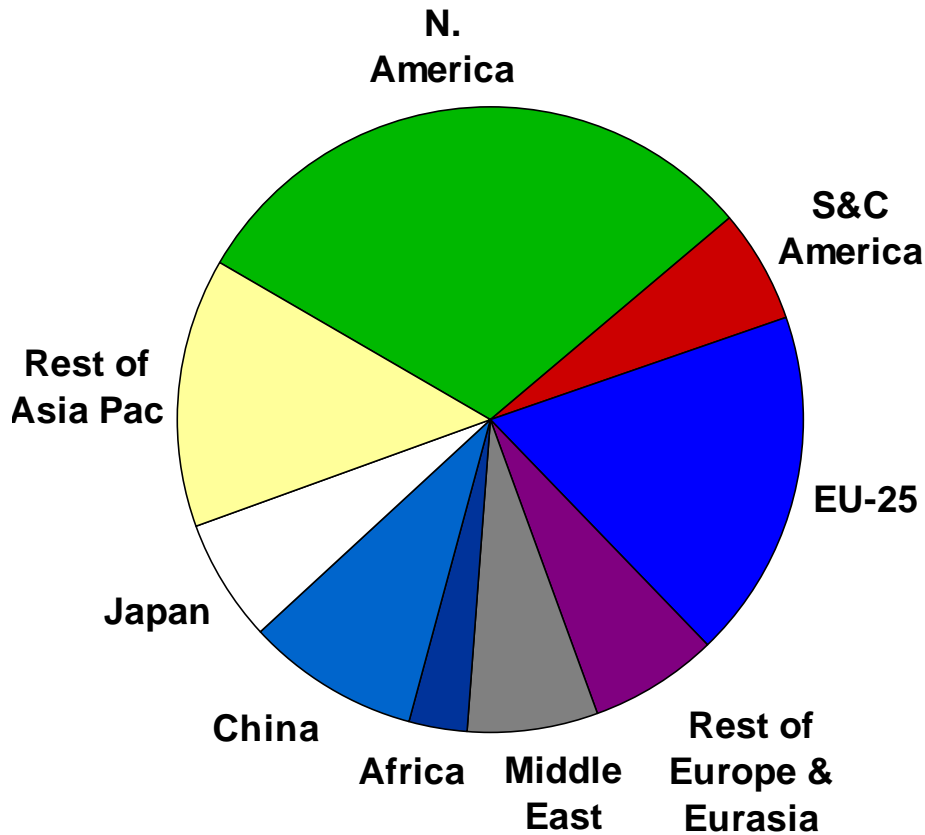
# Growing Gap Between Global Demand and Non-OPEC Supply



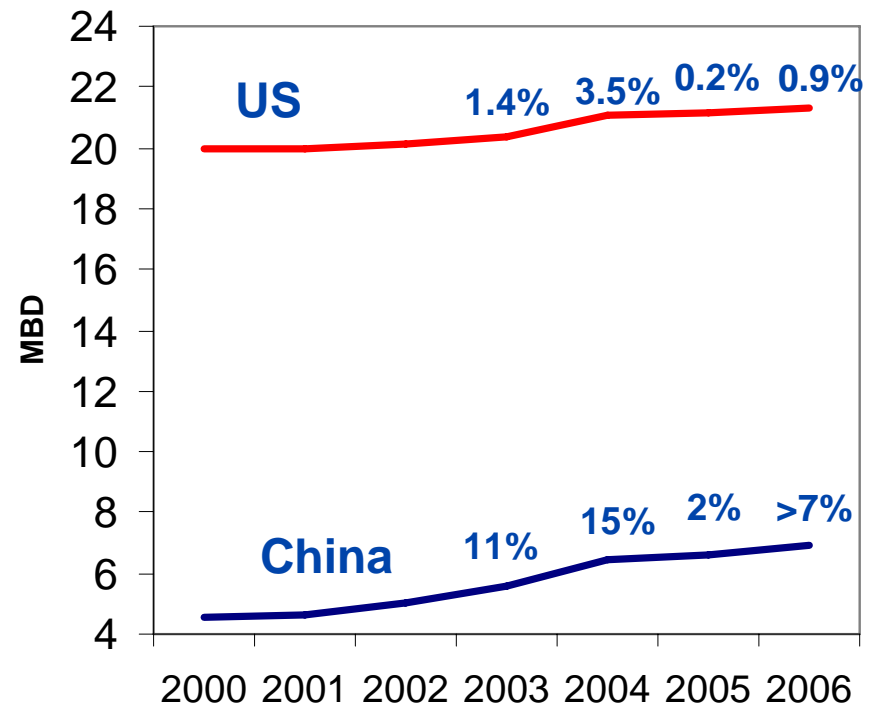
# Demand

# Oil Demand

## World Oil Consumption

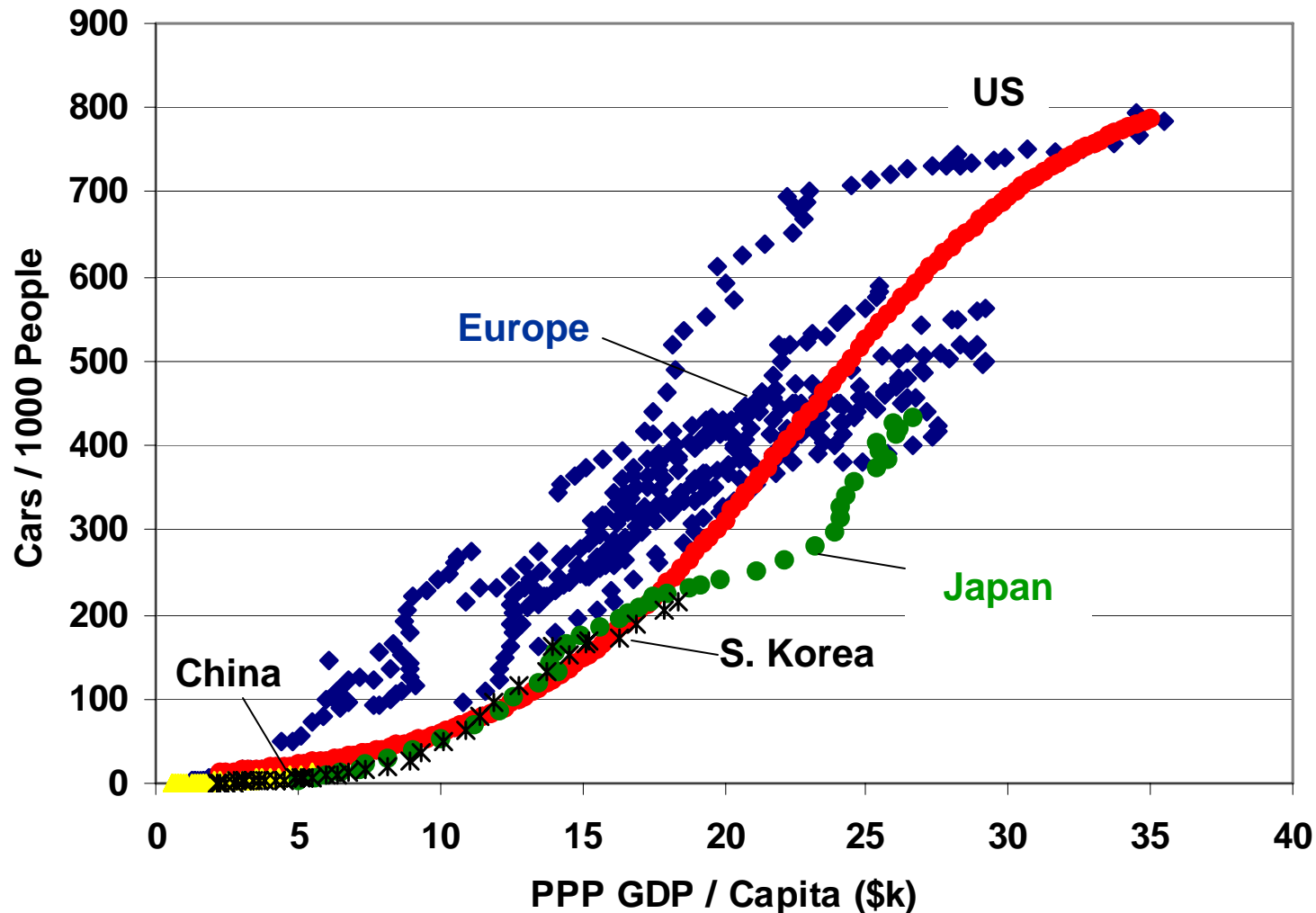


## US vs. China Oil Consumption



# Growth in Non-OECD Car Fleet Just Beginning

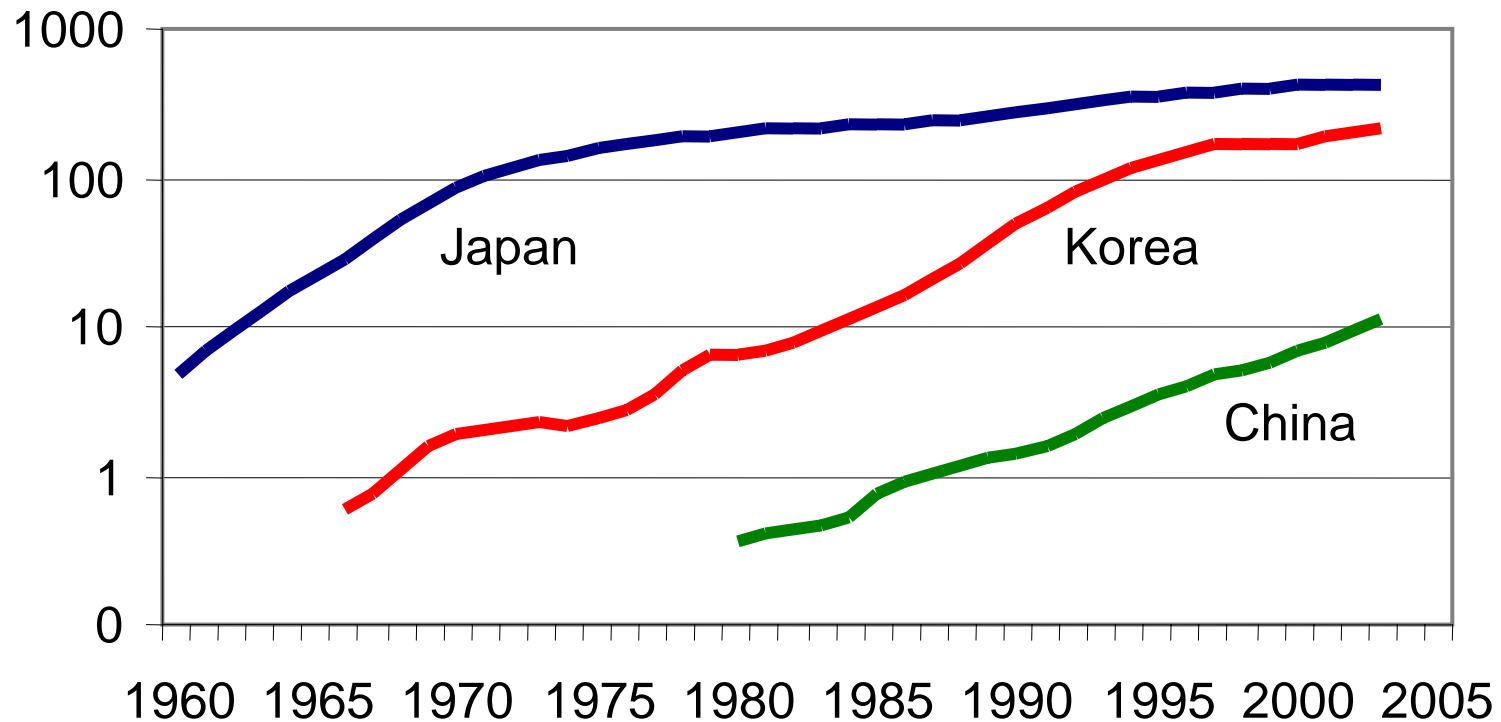
## Cars per 1000 People Historical Data through 2003/04



- Red line / logistics curve derived from regression:  $\text{Cars / 1000 People} = f(\text{PPP GDP per Capita, Population Density, IMF Debt / GDP})$

# Japan / Korea cars per 1000 grew from China's 15-20 to more than 100 in 12 to 15 years

## Cars per 1000 over time (log scale)



## **Policies in the Transportation Sector**

---

- **Rapid fleet growth in the non-OECD could lead to greater impact of technology advances and early-adoption of more efficient vehicles**
  - Possible faster efficiency gains in new fleets in non-OECD than in existing OECD fleets where turnover is slower
  - Cost barriers, e.g. hybrid cost premium may be barrier in the developing world
- **U.S. and other gov'ts play a major role in supporting R&D for fuel and transportation technology, often jointly with private sector**
- **Environmental issues and regulation are intertwined with fuel and transportation technology**
- **Demand-side policies could be more rapid and efficient than supply-side technology policies**
- **Consumers respond more to “shocks” rather than gradual change**

# U.S. Experience

# U.S. Policies in the Transportation Sector

---



- **U.S. policies selectively discourage production, but encourage consumption – this is not sustainable**
- **Structure of energy demand changed with the rise of the suburbs, growing wealth, lifestyle changes and inexpensive energy**
  - The number of U.S. housing units outside of city centers has grown 21% in the last 12 years
- **Due to reliance on autos, there is low elasticity of demand in a high price environment**

# U.S. Policies in the Transportation Sector

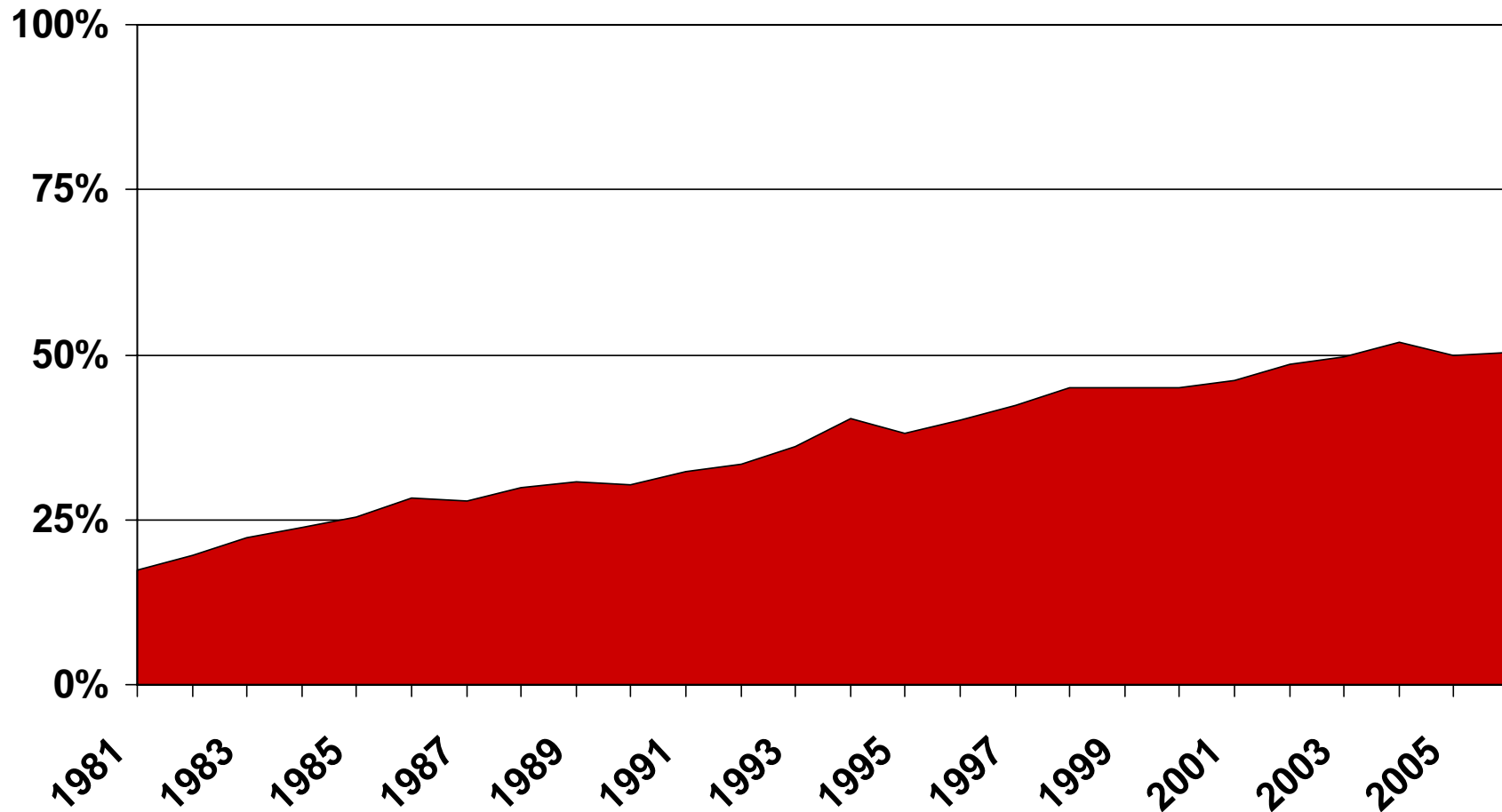
---

- **U.S. Gov't policies distort incentives and outcomes**
  
- **CAFE exemption on light trucks encouraged automakers to sell SUVs and vans**
  - SUVs and vans grew from <4% of all vehicle sales in 1980 to 36% of sales currently
  - Flex-fuel CAFE loophole contributed to Detroit backing inexpensive flex-fuel modifications rather than higher mileage technologies

# U.S. Truck Sales Rise to Over Half of Total

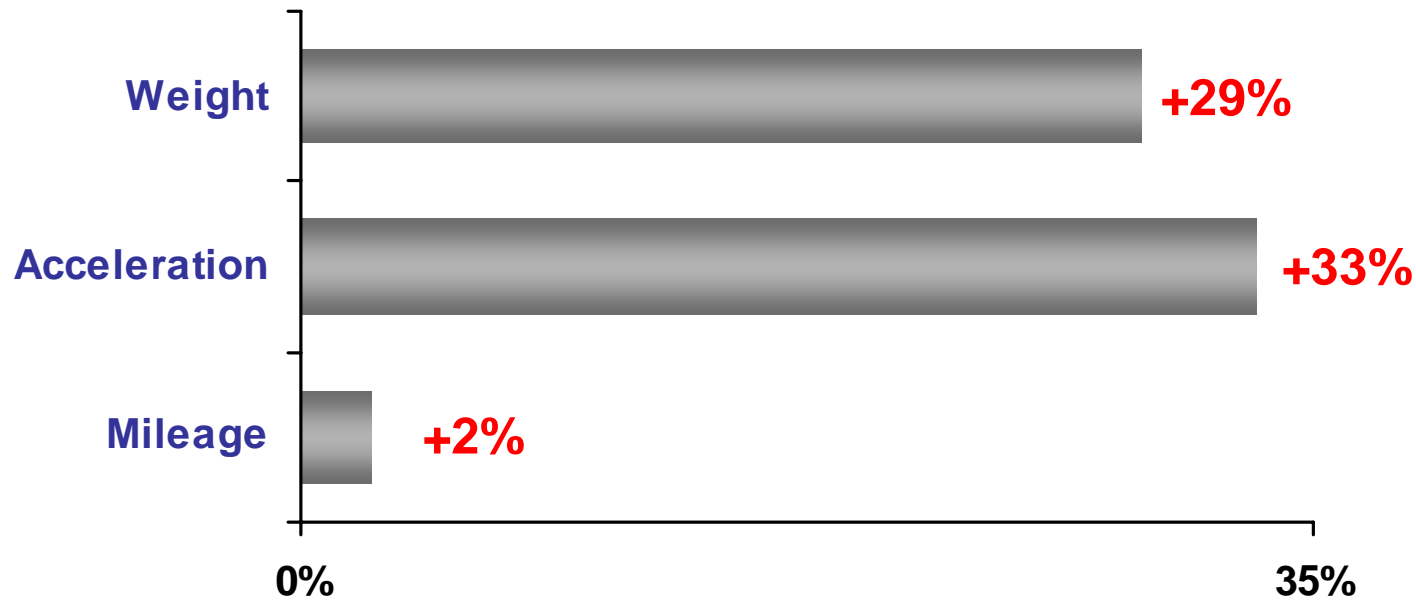


## SUVs, Pickups and Vans: % of All Vehicle Sales



# U.S. Vehicles: Performance Not Mileage

## Performance Tradeoffs: Change Over Past 25 Years



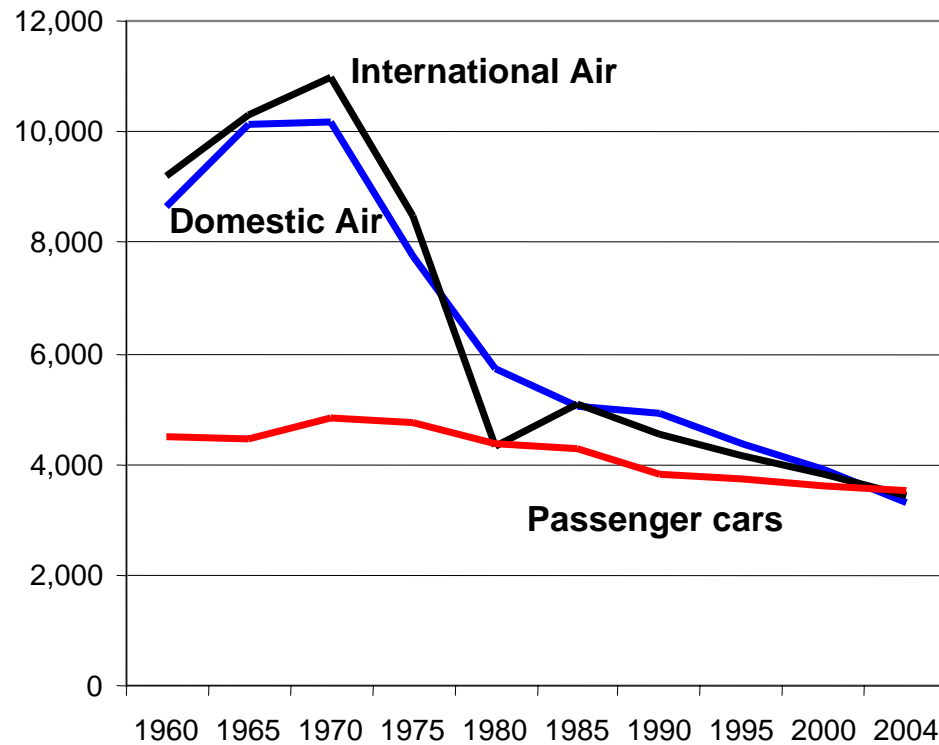
- Avg. horsepower is up 215% over past 25 years; avg. top speed has risen to 137mph vs. 107
- 2005 Toyota Camry goes 0-60 faster than a 1975 Pontiac Firebird TransAm
- U.S. could have improved mileage 25% or more if weight and acceleration were unchanged, possibly saving >2 mill. b/d

# Contrast: Market Incentives Improve Fuel Economy



## Airlines Have Significantly Improved Fuel Economy

BTUs per Passenger Mile  
US Cars and Planes



# Transportation Technology

# Alternative Transportation Technology

Technology	Pro	Con
<b>Clean Diesel</b>	Higher efficiency vs. gasoline: up to 50% better mileage vs. gasoline	Technology to meet NOx and particulate emissions still in commercial development
	10% higher energy content vs. gas	Slightly higher cost per gallon vs. gasoline
	Greater engine longevity	Higher cost engines
<b>Hybrid Engine</b>	High fuel economy	Used by some to boost power vs. mileage
	Currently available technology	Higher cost than existing gasoline engines
	Low emissions	Concerns over battery longevity
<b>Plug-in Hybrid</b>	100+ mpg fuel economy; range not limited by batteries; could be combined with diesel or bio-fuels	Battery issues to be addressed: weight, longevity, safety; Higher cost systems may outweigh savings of low-cost grid power
	Near-term technology	Slow adoption by automakers
	Very low emissions	Electric grid source clean?
<b>Hydrogen fuel cell</b>	No tailpipe emissions	Electric grid source clean?
	Equivalent to an advanced battery	Energy carrier, not energy source
		Low energy efficiency, conversion losses
		Technology issues not resolved; Timeline unknown; Lack of infrastructure
		May postpone other nearer-term technologies

# Alternative Transportation Fuels

Fuel	Pro	Con
<b>Corn Ethanol</b>	Cleaner, renewable, domestic fuel source	Lower energy content vs. gasoline
	Goal of US E10 usage is manageable and can have a positive impact on fuel supply	Lack of infrastructure for E85
		Higher cost per gallon vs. gasoline; requires subsidies
		Distillation is energy intensive
		Limited corn growing capacity
<b>Cellulosic Ethanol</b>	Cleaner, renewable, domestic fuel source	Technology issues not resolved
	Potential higher efficiency than corn ethanol	Timeline unknown
<b>Bio-Diesel</b>	Cleaner, renewable, domestic fuel source	Higher cost per gallon in most cases
		Minor cold weather and other issues for high bio-diesel blends

## Innovation – The Challenge

---

- **Commercial realities over Intellectual Property are inhibiting the abilities of researchers to openly and actively collaborate**
- **Even if this were solved, it is not clear what the core problems are to be solved in support of enhanced or alternative technologies**
- **And ... even if we knew them, the current approach allows for sequential discovery increments, rather than parallel breakthroughs**
- **Calls for “Manhattan Project”**
  - Speed can’t be replicated due to patent and legal system
  - Would require streamlined processes
  - Increased collaborative efforts with governments, academic institutions and private sector

# Conclusions

# Policies & Technology in the Transportation Sector

---



- **Key is to create policies that will drive change**
  - Let the market decide the best technologies
  - Policy should back outcomes, not specific technologies
    - Gov't should not mandate winners and losers – consumers should
  - “Feebates” on vehicles based on mileage may be preferable market-based mechanism
- **Accelerate and simplify intellectual property process to speed innovation**
- **Have government and large corporate fleet buyers work together in cars and light trucks**
  - Large volume purchases to accelerate demand and jumpstart production of advanced technology vehicles
- **Better land use planning, highways and mass transit**



## Strategic Advisors in Global Energy

PFC Energy consultants are present in the following locations:

- ▶ Bahrain
- ▶ Beijing
- ▶ Buenos Aires
- ▶ Calgary
- ▶ **Houston**
- ▶ **Kuala Lumpur**
- ▶ Lausanne
- ▶ London
- ▶ Mumbai
- ▶ New York
- ▶ **Paris**
- ▶ San Francisco
- ▶ **Washington, D.C.**

*Main regional offices are shown in bold.*

[www.pfcenergy.com](http://www.pfcenergy.com) | [info@pfcenergy.com](mailto:info@pfcenergy.com)

**Main regional offices:**

▶ **Asia**

Level 9 South Block  
Wisma Selangor Dredging  
142-A Jalan Ampang  
50450 Kuala Lumpur, Malaysia  
Tel (60 3) 2168-8870  
Fax (60 3) 2161-0702

▶ **Europe**

3 cité Paradis  
75010 Paris, France  
Tel (33 1) 4770-2900  
Fax (33 1) 4770-5905

▶ **North America**

1300 Connecticut Avenue, N.W., Suite 800  
Washington, D.C. 20036, USA  
Tel (1 202) 872-1199  
Fax (1 202) 872-1219  
  
4545 Post Oak Place, Suite 312  
Houston, Texas 77027-3110, USA  
Tel (1 713) 622-4447  
Fax (1 713) 622-4448