Policies and Technology in the Transportation Sector

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PFC Energy
Introduction

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

The Growing Differential Between Non-OPEC Supply Capacity and Global Demand

Daily Production (mbopd)

Non OPEC Crude Oil
Non-OPEC NGL
Non-OPEC Oil Sands
1.1% Growth
1.8% Growth
2.4% Growth
Demand
Oil Demand

World Oil Consumption

N. America
S&C America
Rest of Asia Pac
Japan
China
Africa
Middle East
Rest of Europe & Eurasia

US vs. China Oil Consumption

US
1.4% 3.5% 0.2% 0.9%

China
11% 15% 2% >7%

2000 2001 2002 2003 2004 2005 2006
Growth in Non-OECD Car Fleet Just Beginning

Cars per 1000 People
Historical Data through 2003/04

- Red line / logistics curve derived from regression: \( \text{Cars / 1000 People} = f(\text{PPP GDP per Capita}, \text{Population Density}, \text{IMF Debt / GDP}) \)
Japan / Korea cars per 1000 grew from China’s 15-20 to more than 100 in 12 to 15 years
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
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

Source: U.S. Environmental Protection Agency; Cars and Trucks 2006 vs. 1981
Airlines Have Significantly Improved Fuel Economy

BTUs per Passenger Mile
US Cars and Planes
Transportation Technology
# Alternative Transportation Technology

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

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

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