The Oil Market
A Perspective on the Past and A Look to the Future

PART 1

Japan Oil, Gas, and Metals National Corporation
Tokyo

January 27. 2009
Lucian Pugliaresi
Guy Caruso*
Washington, DC

www.eprinc.org

*Mr. Caruso is a Senior Advisor to CSIS and a Member of the Board of Trustees of EPRINC
Introduction

Energy Policy Research Foundation Inc. (EPRINC), formerly the Petroleum Industry Research Foundation Inc. (PIRINC)

Founded in NY in 1944

– Moved to Washington from NYC in Feb 2007
– EPRINC brings policy analysis and industry economics to bear on current energy issues

*Note: All data in this presentation are from EIA unless otherwise noted. Summary conclusions, comments, etc, are the sole responsibility of EPRINC.*
EPRINC
Fighting Ignorance About Oil Markets Since 1944*

* It’s taking longer than we thought.
Alternative Titles

• High Cost of Pandering
• “Hey, Am I the Only Person Who was Alive in the 70s?”
• What happens when you ask the wrong questions?
• Where’s the Humility?
• The Black Swan (silent evidence, know-how vs. know-what, turkeys)
A Turkey Before and After Thanksgiving (Hume's Problem)

Happiness Index vs. Consecutive Days Fed by Friendly Humans

A Thanksgiving Surprise!
THE TAKE AWAYS

or

EPRINC’s UNIFIED THEORY

• Expectations Matter (and sometimes they come true)
• Recent Run Up in Oil Prices Was A Supply Disruption (no one saw it because it wasn’t in the briefing book)
• Peak Oil is for Sissies
• What Things Cost are Important (especially if there are no benefits)
• Lower Imports Will Not Buy a Lot of Energy Security (within the likely range)
• Petroleum Products, i.e., gasoline, diesel, jet fuel are made from Crude Oil (this is more important than you think)
Why Did Oil Prices Climb So High?
1973-1974 Arab Oil Embargo

NOT AN EMBARGO, but instead a

- Structural Shift in Ownership and Control of the Resources of the Middle East

- Fundamental Change in Expectations on Production from Middle East Producers

As an Embargo it was a failure, market was integrated (lesson not yet learned by Chavez)
Oil Price, Production, Consumption – 1970 - 1990

1974-75: production declined 4.85%
1979 Price Shock

- OIL MARKET WAS NOT FRAGILE, but instead there was a shift in:
  - expectations regarding regional risk; i.e. more risky
  - Prospects for future output from Iran and Iraq were reduced substantially, i.e., access to those reserves would now be delayed
1986 Price Collapse

- Saudi Arabia abandons role as swing producer at low levels of net demand for SA crude

- Shift in expectations on Saudi decision making within OPEC and as regulator of world oil market

- Sustained reduction in oil use as a percentage of GNP in major Western countries
1998 Price Collapse: Six Central Issues

- Asian economic crisis brings a collapse in net demand
- OPEC misreads the oil market
- Warm 1997-98 summers in N. America, Europe, Asia
- Increase in Russian oil exports as Ruble collapses
- Chinese authorities decrease imports in Q4 of 1998
- UN authorizes increase in Iraqi exportation in 1998
- Asian economic crisis brings a collapse in net demand
Expectations and Reality

Supply/Demand relationship returning to equilibrium

EIA 2001 price projections (on par with those of PIRA, Deutsche Bank, IEA, etc.)

Source: EIA Data and EPRINC Calculations

- World Oil Supply - Actual
- World Oil Demand - Actual
- Expected Supply (EIA 2001 Predictions)
- Expected Demand (EIA 2001 Predictions)
- Actual Price (nominal $/bbl)
- Expected Price
<table>
<thead>
<tr>
<th>Country</th>
<th>Positive Expectations</th>
<th>Negative Events</th>
<th>Lost Production (bpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iraq</td>
<td>Promise of investment in oil sector after war, increased production.</td>
<td>Sustained turmoil drops output below pre-war levels</td>
<td>600,000</td>
</tr>
<tr>
<td>Nigeria</td>
<td>4 mbd expected by 2010</td>
<td>Civil strife and attacks on infrastructure, 2005-2007 saw decline to 2.1 mbd</td>
<td>500-700,000</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Potential for growth after stagnant production</td>
<td>Nationalization of oil industry, production nosedive</td>
<td>800,000</td>
</tr>
<tr>
<td>Russia</td>
<td>Projection seen at 12 mbd by 2010 after privatization of industry brought western influence, $ and new production</td>
<td>Re-nationalization leads to decreased production and investment</td>
<td>200,000</td>
</tr>
<tr>
<td>Sudan</td>
<td>Additional proven reserves and access to new fields</td>
<td>Civil strife, attacks on infrastructure, new fields remain inaccessible</td>
<td>200,000-250,000</td>
</tr>
</tbody>
</table>
### A Series of Unfortunate Events (cont.)

<table>
<thead>
<tr>
<th>Country</th>
<th>Event Description</th>
<th>Cause</th>
<th>Estimated Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Huge production gains from 1991-2001</td>
<td>Oil industry nationalized in 2004, production and investment dropped</td>
<td>100,000</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>Production from Kashagan was expected to begin in 2005</td>
<td>Technical difficulties with some political disagreements</td>
<td>TBD</td>
</tr>
<tr>
<td>US</td>
<td>ANWR was part of Bush's energy policy when he took office in 2000</td>
<td>Currently no access to ANWR or OCS</td>
<td>up to 1,000,000</td>
</tr>
<tr>
<td>Canada (Alberta)</td>
<td>Oil sands contain 95% of Canada's 179 billion barrels of reserves</td>
<td>In 2007 new taxes and royalty rates helped to reduce lease sale revenues by 50% compared to 2006</td>
<td>TBD</td>
</tr>
<tr>
<td>Mexico</td>
<td>Production expected to reach 4 mbd by 2005</td>
<td>Production in decline since 2004. Cantarell declining and PEMEX needs funding.</td>
<td>500,000 +</td>
</tr>
<tr>
<td></td>
<td>Estimated loss of supplies to the world market, 2005-2010:</td>
<td></td>
<td>2.5-4.5 mbd</td>
</tr>
</tbody>
</table>
Demand Destruction Worldwide

- Global demand down 50,000 bpd in 2008 y-o-y, led by 1.5 mbd OECD reduction. 2009 will see additional 450,000 bpd reduction (EIA)

2009 expected to see slight non-OECD demand growth...

While OECD will reduce demand by 1 mbd, after 1.5 mbd reduction in 2008
World Oil Production - Significant Post-2006 Growth

Source: EIA Data
What’s Happened Since 2007?

2 mbd swing in 3 quarters

Source: EIA Data, EPRINC Calculations: All Figures Indexed to 2007

Recent Production Declines - 1997-2008

- Russian declines to continue; some had expected 12 mb/d by 2010
- Note recovery - 2004-2008
Some Production Bright Spots

Other Notable Gains (mbd)
2007 Average -> July, 2008:
  Iran: 0.1
  U.S.: 0.25
  UAE: 0.1
  Sudan: 0.06
  Total: 0.51 mbd
.....Led by OPEC Production
What About Peak Oil

The Wrong Question!!!
The Peak Oil Problem: New Supplies Will Be More Expensive, but We Are Not Running Out of Oil

"One thing is clear: the era of easy oil is over. What we all do next will determine how well we meet the energy needs of the entire world in this century and beyond."

- David J O'Reilly, Chairman & CEO, Chevron Corporation, July 2005
## San Joaquin Valley
Testing Hubbard-Method Predictions for Reserves and Production
(Billions of Barrels)

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1982</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Discoveries</td>
<td>7.7</td>
<td>11.8</td>
<td>16.1</td>
</tr>
<tr>
<td>Percent Attributable to 1915</td>
<td>49%</td>
<td>69%</td>
<td>76%</td>
</tr>
<tr>
<td>Cumulative production as of</td>
<td>8.0-9.5</td>
<td>11.9-12.1</td>
<td>16.1-16.2</td>
</tr>
<tr>
<td>Year 2000 production projected in: (mb/d)</td>
<td>44-112</td>
<td>189</td>
<td>597(actual)</td>
</tr>
</tbody>
</table>

Source: EPRINC, October 2006. *Does the Hubbard Method Provide a Reliable Means for Predicting Future Oil Production*, Richard Nehring, October 2006,
### Permian Basin

**Testing Hubbard-Method Predictions for Reserves and Production**

**(Billions of Barrels)**

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1982</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Discoveries</td>
<td>17.6</td>
<td>27.9</td>
<td>35.2</td>
</tr>
<tr>
<td>Percent Attributable to 1950</td>
<td>85%</td>
<td>86%</td>
<td>84%</td>
</tr>
<tr>
<td>Cumulative production as of</td>
<td>19-27.5</td>
<td>28.5-30.5</td>
<td>35.8-37.5</td>
</tr>
<tr>
<td>Year 2000 production projected in: (mb/d)</td>
<td>162-479</td>
<td>326-479</td>
<td>910(actual)</td>
</tr>
</tbody>
</table>

Source: EPRINC, October 2006. *Does the Hubbard Method Provide a Reliable Means for Predicting Future Oil Production*, Richard Nehring, October 2006,
Real Imported Crude Oil Prices – 1980 - 2008

Source: EIA Data. Real Imported Crude Price, November 2008 STEO

Source: EIA
Lower 48 Crude Production and Drilling Activity

- Oil Price ($/bbl)
- Lower 48 Production (100,000 mbd)
- Lower 48 Wells Drilled as % of Total Wells (right axis)

Minor production growth after oil breaks $30/bbl
Why You Should Stop Worrying About Peak Oil

• You’ll never get the right answer

• Put your effort into something useful, such as the backstop price

• Congress has already decided that any alternative fuel, no matter how expensive, is worth supporting as an alternative to petroleum
ETHANOL

A CAUTIONARY TALE
US Ethanol Production: 2005-2008

Source: EIA Data, EPRINC Calculations
Ethanol’s Share of Crude Products and Gasoline
The Cost of Ethanol and the Gasoline Pool

Reflects ethanol’s value as an oxygenate and octane booster.

Blender’s Credit = $0.51, current ethanol – RBOB spread = $0.53

Once the gasoline pool hits 10% ethanol, additions must come from E85 sales.

Source: Bloomberg, CBOT. Futures prices for front month contracts as of November 17, 2008.
Ability of Ethanol Producers to Pay for Corn

Break-even point represents break-even for short-term operating costs, not capital costs.

Source: CBOT, Iowa Ag Review – Iowa State
Cost of Ethanol Subsidies

• $7 billion per year (Economist, 2007)
  • About $1.90/gallon.
  • More than 200 types of subsidies
    • $11.2bn+ since 2005 on tax breaks for companies that blend ethanol into petrol (Financial Times)
    • Billions of dollars of subsidies for ethanol producers
  • Tariff on ethanol imports
    • Aimed at preventing imports from Brazil
    • 54 cents/gallon

Source: The Economist, Financial Times
SHOULD WE DRILL FOR OIL*

*AKA, BIG OIL SHOULD USE IT OR LOSE IT
U.S. Crude Oil Net Imports

Worst-Case Economic Scenario: 0% Annual GDP Growth Through 2020

With Crude Oil Prices Rising 3% Annually
Gulf of Mexico Deepwater Frontier Exploration and Production Timeline
Individual Prospect: 5,000' Water Depth, 30,000' Drilling Depth

<table>
<thead>
<tr>
<th>Cost (millions)</th>
<th>Cumulative Cost (millions)</th>
<th>Activity</th>
<th>Lease Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1-5</td>
<td>$1-5</td>
<td>Acquire 2D and 3D seismic and evaluate geological, geophysical and engineering data to identify lease/drilling ideas. Prepare bids for lease sale.</td>
<td>-3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13</td>
</tr>
<tr>
<td>$10-200</td>
<td>$11-205</td>
<td>Lease sale - sealed competitive bidding process.</td>
<td>Lease Sale</td>
</tr>
<tr>
<td>$1-2</td>
<td>$12-207</td>
<td>High bid leases awarded (10 year term). Cumulative annual lease rentals.</td>
<td></td>
</tr>
<tr>
<td>$5-10</td>
<td>$17-217</td>
<td>Acquire and interpret 3D and other data to turn ideas into drillable prospects. Find partners to share costs to drill exploratory well. Perform shallow hazard, archaeological and other regulatory permitting requirements to obtain Federal approval to drill.</td>
<td></td>
</tr>
<tr>
<td>$100-150</td>
<td>$117-367</td>
<td>Contract a rig to drill. Drill exploration well. If exploration well unsuccessful, start process over</td>
<td>Discovery</td>
</tr>
<tr>
<td>$40-60</td>
<td>$157-427</td>
<td>Drill sidetrack to exploration well. Evaluate results.</td>
<td></td>
</tr>
<tr>
<td>$100-300</td>
<td>$257-727</td>
<td>If encouraging, drill appraisal/development well(s) and sidetrack(s). Evaluate well results, formulate plan of development for discovery. Prepare and file permits for development, wait for approval.</td>
<td></td>
</tr>
<tr>
<td>$1,000-5,000</td>
<td>$1,300-5,700</td>
<td>Sanction commerciality, build and install facility, drill and complete producing wells to achieve production.</td>
<td>Last Production</td>
</tr>
</tbody>
</table>

Legend: 
- Pre-lease evaluation
- Lease Term
- Exploration Phase
- Development Phase
Highlights from *Oil in the Sea III* (2003)

- “Operational discharges from vessels in general and tankers in particular have substantially declined over the last 25 years.
- Only 1 percent of the oil discharges in North American waters is related to the extraction of petroleum.
- Although large quantities of VOC (volatile organic compounds) are emitted from tankers and production platforms, these consist of mostly lighter compounds and only small amounts deposit to the sea surface.”
U.S. Gov’t Revenues from Leases

• FY2008 – “Minerals Management Service had distributed a record $23.4 billion to state, American Indian and federal accounts from onshore and offshore energy production”
  – $10 billion from bonus bid payments from lease sales
  – $17.3 billion went to the U.S. Treasury

• 2007 - $11.6 billion
• 2006 - $12.8 billion

Oil’s Tax Bill

Income Taxes Paid in 2006: Oil Companies vs. The Bottom 75% of Individual Taxpayers

- Oil Company Income Taxes Paid in 2006: $138B
- Income Taxes Paid by the Bottom 75% in 2006 (estimate): $136B

Source: API
Are We Using Too Much Oil?
World GDP vs. Oil Production

Growth Rates

Levels

Source: Federal Reserve Board and International Energy Agency. World GDP aggregate weighted by world oil consumption shares.

Source: CFTC Interim Report on Crude Oil, June 2008
Oil Intensity of GDP

Source: International Monetary Fund and International Energy Agency. GDP is real GDP for each country in billions of 2000 U.S. dollars.

Source: CFTC Interim Report on Crude Oil, June 2008
Cost to consumers.....

**PAYING MORE FOR HEAT**

Consumers are expected to pay record prices for heating this winter. Projected average household expenditures and percentage change from 2007-08 costs:

<table>
<thead>
<tr>
<th>Expenditures</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating oil $2,644</td>
<td>36.3%</td>
</tr>
<tr>
<td>Natural gas $1,059</td>
<td>23.8%</td>
</tr>
<tr>
<td>Electricity $939</td>
<td>9.4%</td>
</tr>
</tbody>
</table>

*Source: Energy Information Administration*

---

*Source: New York Times, USA Today*
U.S. Annual Energy Expenditures As Percent of Gross Domestic Product

Short-Term Energy Outlook, November 2008

Source: EIA Data
Some Observations on the Gazprom Supply Crisis
Gazprom and Ukraine: Economics or Politics?

- Difficult to discern the role of politics, but there are economic factors at play:
  - Gazprom and Ukraine could not agree on a price for 2009 gas:
    - 2008 gas: $179.50/tcm
    - 2009, Gazprom offered: $250/tcm
      - Rejected by Ukraine who made counteroffer of $235/tcm with a $0.10/100 km increase of gas transit fee (Ukraine earns ~$3 billion/year from transit fees)

Source: EIA
Gazprom Facing New Economic Environment

- Beginning in 2009, Gazprom begins to pay closer to European market price for Central Asian Gas:
  - $130-180 in 2008, $200-300 in 2009
    - Gazprom buys ~60 bcm/year from Central Asia and exports ~130 bcm/year to Europe
  - European customers pay ~$450/tcm
  - Gazprom requested Gov’t loans for power projects
  - Has acknowledged that gas prices will decline later in around Q2 2009 when lower crude prices catch up
What is Ukraine Risking?

- Leaving transit fees on the table (~$3 billion/year)
- A higher contract price for 2009
  - After Ukraine rejected $250/tcm, Gazprom has said Ukraine may end up paying European market price (~$400 tcm)
- Russia could look to alternate distribution routes
  - Nordsea, BlueStream, Yamal...
European Response to Gas Cutoff

- Varies by country based on economic and storage situations.
  - Western Europe mostly unaffected - less dependent on Russian gas and most countries have robust storage.
- Eastern Europe most at risk
  - Slovakia and Hungary curbing industrial use and encouraging switch to oil products.
  - Bulgaria limiting supplies and will increase use of black oil.
  - Romania tapping reserves, has 60-80 days for consumers.
  - Poland reducing industrial use.
  - Turkey cutting gas-fired power plant output.
World Energy Issues and Trends: A Look Ahead

Japan Oil, Gas, and Metals National Corporation
January 27, 2009
Tokyo, Japan

Guy Caruso
Oil market fundamentals had driven the 5-year run-up in prices. Those fundamentals have shifted and are now responsible for the current collapse.

World oil markets had become increasingly tight from 2003 to mid-2008.

- Global demand growth, fed by worldwide economic growth, exceeded non-OPEC supply additions.
- OPEC and NOCs, controlling a vast majority of proved reserves, were relied upon to fill the gap, but their production rose only modestly.
- This led to market tightening, which in turn increased sensitivity to other non-fundamental factors.
- Geopolitical uncertainty in oil producing countries contributes to risk of supply disruptions. Low levels of surplus production capacity during this time heightened this risk.
- Rising prices were a direct result of these conditions.

We are now witnessing a shift, driven by worsening global economic conditions and demand fundamentals, that is exerting downward pressure on prices.

- The current financial crisis has dampened global economic growth leading to the collapse in oil prices – conditions in Asia and the Middle East have also deteriorated significantly.
- The depth and duration of the current economic downturn will be a key price determinant.
- The drastic swing in prices will take a toll on future supply projects, shortening slack in the future market when economic recovery boosts demand. This likely means we will see a return in the mid-term to sharply higher oil prices – and so the cycle continues...
Despite higher prices, world oil demand growth was strong 2003-2007. An obvious shift occurred in 2008 that is expected to continue in 2009.

- During 2003-2007, world oil consumption growth averaged 1.7% per year. Next year may see a decline.
- Non-OECD countries, especially China, India, and the Middle East, represented the largest part of this growth. But even in these countries, consumption is expected to stagnate in 2009.

Source: EIA, STEO December 2008
As demand dips, the world oil market will loosen, taking pressure off of previously strained supply capacity.

- World oil consumption growth had outpaced non-OPEC supply growth every year since 2003, increasing reliance upon OPEC production and/or inventories to fill the gap.
- Because consumption may actually decline while non-OPEC supply growth remains steady, OPEC instead will face supply cuts in order to stabilize prices.

Source: EIA, STEO August 2008
World surplus production capacity is a key indicator of world oil market vulnerability.

- World surplus production capacity will surge above historic levels in 2009.
- In addition, it is highly concentrated in a few countries, with Saudi Arabia holding a large proportion of this capacity.

OPEC Surplus Crude Oil Production Capacity

Note: Shaded area represents 1997-2007 average (2.9 million barrels per day)

Source: EIA, STEO December 2008
Global Oil Market: Key Indicators, 2009-2012

Oil Demand in Emerging Economies
New Investments in Productive capacity
New Investments in Refinery Capacity
Financial Investments in Oil Futures
A Changing Energy Landscape in the Long-Term

- Continued but uneven demand growth;
- Concentration of conventional resources; strained delivery systems;
- Resource Endowment is enormous, but “Above Ground” Issues worrisome;
- Fuels Choices driven by Economic, Security and Environmental Considerations;
- New Players Emerging with new agendas, business models, leverage and alliances – New Rules/Institutions?
- Projected Impacts of Climate Change & Carbon Constraints are Potential Game Changers
Global Energy Consumption

2005
462 Quadrillion Btu

- Liquids: 37%
- Natural Gas: 26%
- Coal: 23%
- Renewables: 8%
- Nuclear: 6%

2030
695 Quadrillion Btu

- Liquids: 33%
- Natural Gas: 29%
- Coal: 24%
- Renewables: 6%
- Nuclear: 8%

Source: EIA/IEO 2008
Consumption in Developing World

2005
221 Quadrillion Btu

- Liquids: 32%
- Natural Gas: 34%
- Coal: 24%
- Nuclear: 2%
- Renewables: 8%

2030
409 Quadrillion Btu

- Liquids: 30%
- Natural Gas: 36%
- Coal: 24%
- Nuclear: 7%
- Renewables: 3%

Source: EIA/IEO 2008
Demand growth is increasingly driven by consumption in developing countries.

**World Marketed Energy Use: OECD and Non-OECD**

<table>
<thead>
<tr>
<th>Year</th>
<th>Quadrillion Btu</th>
<th>History</th>
<th>Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>~140</td>
<td>221</td>
<td>241</td>
</tr>
<tr>
<td>1985</td>
<td>~150</td>
<td></td>
<td>286</td>
</tr>
<tr>
<td>1990</td>
<td>~160</td>
<td></td>
<td>409</td>
</tr>
<tr>
<td>1995</td>
<td>~170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>~180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>~190</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>~200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>~210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>~220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>~230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>~240</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: EIA/IEO 2008
Large resources exist, but are unevenly distributed and increasingly constrained by “above ground” risks.
Resource distribution does not match up with consumption patterns.

2005 Proved Oil Reserves and Projected Total Liquids Consumption from 2004 through 2030 (bb)

- **North America**
  - Reserves: 211
  - Consumption: 278

- **Central and South America**
  - Reserves: 110
  - Consumption: 77

- **Middle East**
  - Reserves: 748
  - Consumption: 79

- **Africa**
  - Reserves: 115
  - Consumption: 39

- **OECD Europe**
  - Reserves: 14
  - Consumption: 154

- **Non-OECD Europe/Eurasia**
  - Reserves: 99
  - Consumption: 55

- **Asia and Oceania**
  - Reserves: 34
  - Consumption: 307

If global demand increases without adequate investment in new production capacity, given natural decline rates, there is risk of a significant liquids supply gap.

Source: CSIS, National Petroleum Council
National Oil Companies (NOCs), controlling 80-90% of conventional oil and gas reserves will have a critical role in managing resources.

Sources: PFC Energy, HFHS
Accumulating Geopolitical Risks

- US: Access & Climate Policy
- Europe: Gas Supplies
- Caspian: Transit Security
- Russia: Policy
- Iran: Nuclear Ambition
- China: Demand Increase
- N-Korea: Nuclear Ambition
- US: Hurricanes
- Iraq: Sabotage
- Latin America: Resource Nationalism
- Nigeria: Civil Unrest
- Pakistan: Political Turmoil
- Strait of Malacca: Piracy
Implications of Emerging Long-Term Trends

Restricted access and investment likely to extend timetable for bringing needed fuels to market

Market may become less efficient and flexible as capital, management, technology and labor are redirected

Competition for resources could intensify

High price environment likely to increase disparity between “haves” and “have-nots”

Reduced leverage of “Western economies” accelerates changing game & changing rules
But change is afoot that could shift these trends …

Scope and duration of the financial crisis
OPEC actions to manage the market
Macroeconomic trends in emerging economies
Unforeseen disruptions/political events
Timing of technologies
Policies to mitigate climate change
Climate Change & Carbon Constraints

Affects supply & demand
Alters fuels choices, increases prices
In the extreme, raises security concerns
New investment & technologies must be applied on a global scale
Concept of “Sustainable Development” challenges traditional view of economic prosperity
Requires long-term global policy solutions and trade-off balances
Drivers for Obama’s Energy Policy

1. **Energy Security:** Goal for US to reduce oil consumption by an amount equivalent to imports from the Middle East and Venezuela

2. **The Environment:** Will reduce GHG emissions to 80% below 1990 levels by 2050 through cap and trade

3. **Green Jobs:** Wants to retool and build industries to develop efficient technologies and emissions-free energy

4. **Short-term Consumer Relief:** Will provide rebates to consumers through industry tax hikes.
Projected Petroleum Imports

- History
- Consumption
- Domestic Supply
- Projections
- Net Imports: 54%
- 60% increase

Source: EIA/AEO 2008
## U.S. Petroleum Imports

<table>
<thead>
<tr>
<th>Country</th>
<th>2007 Imports (million b/d)</th>
<th>% of total U.S. Imports</th>
<th>% of total U.S. consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Canada</td>
<td>2.407</td>
<td>17.9</td>
<td>11.6</td>
</tr>
<tr>
<td>2. Mexico</td>
<td>1.566</td>
<td>11.7</td>
<td>7.6</td>
</tr>
<tr>
<td>3. Saudi Arabia</td>
<td>1.563</td>
<td>11.6</td>
<td>7.5</td>
</tr>
<tr>
<td>4. Venezuela</td>
<td>1.195</td>
<td>8.9</td>
<td>5.8</td>
</tr>
<tr>
<td>5. Nigeria</td>
<td>1.136</td>
<td>8.5</td>
<td>5.5</td>
</tr>
<tr>
<td>6. Algeria</td>
<td>0.778</td>
<td>5.8</td>
<td>3.8</td>
</tr>
<tr>
<td>7. Angola</td>
<td>0.574</td>
<td>4.3</td>
<td>2.8</td>
</tr>
<tr>
<td>8. Iraq</td>
<td>0.531</td>
<td>4.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Persian Gulf + Ven</td>
<td>3.524</td>
<td>26.2</td>
<td>17.0</td>
</tr>
<tr>
<td>OPEC</td>
<td>5.980</td>
<td>44.5</td>
<td>28.9</td>
</tr>
<tr>
<td><strong>Total U.S. Imports</strong></td>
<td><strong>13.439</strong></td>
<td><strong>100</strong></td>
<td><strong>64.9</strong></td>
</tr>
</tbody>
</table>

*Source: EIA*
Emissions of Carbon Dioxide

Total Carbon Dioxide Emissions

- Electricity
- Coal
- Natural Gas
- Petroleum

Delivered, including electricity losses

Source: EIA/AEO 2008
What it takes to offset 1 gigaton of carbon...

<table>
<thead>
<tr>
<th>TODAY’S TECHNOLOGY</th>
<th>Actions providing 1 Gt mitigation/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-fired power plants</td>
<td>Build 1,000 “zero-emission” 500 MW coal-fired power plants</td>
</tr>
<tr>
<td>Geologic sequestration</td>
<td>Install 3,700 sequestration sites like Norway’s Sleipner project (0.27 MtC/year)</td>
</tr>
<tr>
<td>Nuclear</td>
<td>Build 500 new nuclear plants, each 1 GW in size</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Deploy 1 billion new cars at 40 miles per gallon (mpg) instead of 20 mpg</td>
</tr>
<tr>
<td>Wind energy</td>
<td>Install capacity to supply 50 times the current global wind generation</td>
</tr>
<tr>
<td>Solar photovoltaics</td>
<td>Install capacity to supply 1000 times the current global solar PV generation</td>
</tr>
<tr>
<td>Biofuels for transport</td>
<td>Convert a barren area 15 times the size of Iowa’s farmland (30 million acres) to biomass production</td>
</tr>
<tr>
<td>CO₂ storage in forests</td>
<td>Convert a barren area 30 times the size of Iowa’s farmland to new forest</td>
</tr>
</tbody>
</table>

Source: DOE Climate Change Technology Program
What could be the implications for energy policy?

- **Reducing oil consumption (imports)** in transport sector through efficiency (CAFE), technology, and biofuels
- **Increased oil industry taxes** to offset spending on consumer relief, renewables/efficiency
- What will be the **verdict on the OCS**?
- Has shown strong **support for biofuels** production
- 1 million **PHEVs** on the road by 2015
- **Renewable portfolio standard** – 10% by 2012, 25% by 2025
- Increased **funding for energy technology** development and deployment ($150 billion over 10 years)
- Economy wide **cap-and-trade** to reduce emissions
Renewable Fuels Standard

• The Energy Independence and Security Act of 2007 increased the renewable fuels standard originally set forth in EPACT 2005
  • 9 billion gallons in 2008 to 36 billion gallons in 2022
• With a tremendous slump in oil prices, the value of blending ethanol has diminished
• With high corn prices, biorefiners are dependent on the $0.51/gallon production credit
Roles and Responsibilities of Actors in Energy Policy

Executive: Obama Administration

- It is faced with a myriad of priorities – the economy, wars in Iraq and Afghanistan, energy, and healthcare
- How will responsibilities be divided – DOE, State, the NSC, EPA, the White House?
- Available tools: executive orders, vetoes, programs

Legislators: Senate and the House

- Various committees will craft legislation – Senate Energy, Senate Environment and Public Works, House Energy and Commerce
- Will Democrats be able to align their varying priorities/interests?
Summary

- Oil Market Outlook Tied To Economic Recovery
- Geopolitics Can Trump Economics
- Oil Demand Destruction Mostly Temporary
- Policy Changes Could Have Long-Term Impact