The Lies We’ve Been Told

November 18, 2008
Role of Petroleum in U.S. Energy Policy

Meeting of the Committee on Earth Resources
Board on Earth Sciences and Resources
National Research Council of the National Academies

Domestic Options for the Next Two Decades

Lucian Pugliaresi
Washington, DC

www.eprinc.org
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?
• Everything you think you know about the oil market is wrong
• The Black Swan
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)
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)
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
1986 Price Collapse

Source: EIA Data,
A Series of Unfortunate Events Leading to New Expectations

Positive Expectations

- Expectations Shift

Negative Expectations

- Oil development in Iraq delayed
- Yukos -- Kremlin taking control of Russian oil development
- Russia takes over Sakhalin II, Chavez Nationalizes Projects
- Continuing civil strife in Sudan, Nigeria
- Congress continues ban on ANWR and offshore development
- Nigeria rebels hurt output

Outlook positive for expanded output from Nigeria, Mexico, Venez., Russia, North Slope

OPEC Excess Capacity remains limited

World Oil Production (EIA)

Expected Production (EIA 2001 Predictions)

Crude Oil Price

Global Production, million b/d

2001 2002 2003 2004 2005 2006 2007 2008e

$/bbl

70 75 80 85 90 95

140

100 80 60 40 20

0
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
## A Series of Unfortunate Events, by country:

<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>200-250,000</td>
</tr>
<tr>
<td>Region</td>
<td>Description</td>
<td>Event/Issue</td>
<td>Estimate</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<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>Estimated loss of supplies to the world market, 2005-2010:</td>
<td></td>
<td></td>
<td>2.5-4.5 mbd</td>
</tr>
</tbody>
</table>
Demand Destruction Worldwide

- Global demand down slightly so far this year, OECD decline has been greater than demand growth in non-OECD countries.

2008 world consumption has declined 200,000 bpd from 2007.

2008 OECD consumption declined 1.5 mbd from 2007.
Global Crude Demand – EIA October STEO

- After summer price rally, demand is currently off, in part due to worldwide economic difficulties.
  - Worldwide economic downturn has removed some crude demand from the market
  - EIA has again revised down 2008 crude demand growth – now only +300,000 bbl/d in 2008 over 2007, which is 350,000 bpd lower than last month’s forecast, which itself was a downward revision of earlier estimates.
  - OECD Consumption to decline 1.1 mmbbl/d in 2008.

- However, though some crude supply has rebounded, supply will remain tight.
  - OPEC has cut production in hopes of maintaining high prices
World Oil Production - Significant Post-2006 Growth

Source: EIA Data
What’s Happened Since 2007?

2 mbd swing in 3 quarters

Supply Since Q1 2007
Consumption Since Q1 2007
$/bbl Change Since Q1 2007

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

Recent Production Declines - 1997-2008

Russian declines to continue, some had expected 12 mbd 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
Real Imported Crude Oil Prices – 1980 - 2008

Imported Crude Oil Prices: Nominal and Real

Source: EIA

Short Term Energy Outlook-November 2008
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 Hubbert-Method Predictions for Reserves and Production
(Billions of Barrels)

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

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

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

Source: EPRINC, October 2006. *Does the Hubbert Method Provide a Reliable Means for Predicting Future Oil Production*, Richard Nehring, October 2006,
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
How Not to Transition to the Fuels of the Future

Big Oil, Ethanol and Offshore Leasing
<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 leads/drilling ideas.</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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Find partners to share costs to drill exploratory well.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perform shallow hazard, archeological and other regulatory permitting requirements to obtain Federal approval to drill.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contract a rig to drill.</td>
<td></td>
</tr>
<tr>
<td>$100-150</td>
<td>$117-367</td>
<td>Drill exploration well.</td>
<td>Discovery</td>
</tr>
<tr>
<td>$40-60</td>
<td>$157-427</td>
<td>Drill sidetrack to exploration well.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluate results.</td>
<td></td>
</tr>
<tr>
<td>$100-300</td>
<td>$257-727</td>
<td>If encouraging, drill appraisals/delineation well(s) and sidetrack(s).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluate well results, formulate plan of development for discovery.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process 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>1st Production</td>
</tr>
</tbody>
</table>

Legend: Pre-Leasing Evaluation - Orange; Exploration Phase - Green; Development Phase - Blue; Lease Year - Black; Discovery - Green; 1st Production - Blue.
All estimates from the EIA’s 2008 Annual Energy Outlook. EIA estimates assume EISA2007 biofuel production levels are met.
**Diesel and Gasoline Demand, 2007-2017**

<table>
<thead>
<tr>
<th>Annual growth in real GDP</th>
<th>Annual change in real diesel price</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3%/yr</td>
<td>0%/yr</td>
<td>3%/yr</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td>10</td>
<td>0</td>
<td>-10</td>
<td></td>
</tr>
<tr>
<td>1.5%</td>
<td>20</td>
<td>13</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2.5%</td>
<td>29</td>
<td>22</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>3.5%</td>
<td>40</td>
<td>33</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual growth in real GDP</th>
<th>Annual change in real gasoline price</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3%/yr</td>
<td>0%/yr</td>
<td>3%/yr</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td>16</td>
<td>0</td>
<td>-14</td>
<td></td>
</tr>
<tr>
<td>1.5%</td>
<td>27</td>
<td>10</td>
<td>-7</td>
<td></td>
</tr>
<tr>
<td>2.5%</td>
<td>33</td>
<td>18</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.5%</td>
<td>42</td>
<td>27</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

- Assuming worst case gasoline scenario (0% economic growth, 3%/year price increase resulting in 14% demand reduction in 2017) is applied to crude oil and crude oil production remains constant, the U.S. will be importing ~9.5 mbd. If EISA 2007 is met in 2017 and 14% demand reduction scenario is applied, the U.S. will be importing ~7.9 mbd. (Elasticities can be found in http://eprinc.org/pdf/TenYearOutlookFuelsJuly.pdf)
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
U.S. Gov’t Revenues from Leases

• In 2007 the MMS received $9.4 billion from oil and gas royalties.
  – FY 2007 lease sales raised over $3 billion.

• MMS offshore lease sales thus far in 2008 have generated high bids of over $9 billion.
  • Does not include state revenues, delay rental fees, etc.
  • Royalty revenues may be higher if average FY2008 crude price is comes in higher than 2007.

Source: MMS
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.”
US Ethanol Consumption: 2006 - Present

Mandate requirement assumes 750 million gallons per month for 12 months to reach the 9 billion gallon mandate for 2008.

Source: Renewable Fuels Association
Ethanol and Gasoline

Source: EIA Data, Bloomberg, CME Group, EPRINC Calculations
Ethanol’s Share of Crude Products and Gasoline
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.
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
Synfuels Corp

• Synthetic Fuels Corp. (SFC) - 1979
  • Use coal to produce 2 mbdoe by 1992
  • New jobs and revenues expected, “The new Office of Coal Commerce in the Illinois Department of Commerce and Community Affairs calculates that every 4 million tons' annual increase in coal output creates 4,013 new jobs, producing a $76 million annual increase in personal income in the state, $6.7 million of which ends up in state and local tax coffers.”
  • Cost would be $88 billion over 10 years, partially funded by a windfall profits tax on oil companies.
  • Reagan eventually ended the project in 1986 as oil prices collapsed.

http://www.lib.niu.edu/1982/ii820420.html
TIME Magazine
Are We Using Too Much Oil?
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</td>
<td>$2,644</td>
</tr>
<tr>
<td>Natural gas</td>
<td>$1,059</td>
</tr>
<tr>
<td>Electricity</td>
<td>$939</td>
</tr>
</tbody>
</table>

Source: Energy Information Administration

Source: New York Times, USA Today
Oil Prices by Currency

Exchange Value of the Dollar
Index, Jan. 2002 = 100

Source: Federal Reserve Board. The measure of the dollar is the broad nominal index, and the oil price is spot West Texas Intermediate crude oil.

Oil Prices in Several Currencies
Index, Jan. 2002 = 100

Source: CFTC Interim Report on Crude Oil, June 2008
Slides for Q’s and A’s
World Oil Consumption

Short-Term Energy Outlook, September 2008
World Oil Consumption

Source: CFTC Interim Report on Crude Oil, June 2008

Source: Energy Information Administration
World GDP vs. Oil Production

Growth Rates

4-quarter percent change

Oil Production

World GDP

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

Levels

Index, 2002:Q1 = 100

World GDP

Source: CFTC Interim Report on Crude Oil, June 2008
Operable Refiners and Capacity

![Graph showing the operational capacity of refineries over time](chart.png)

Source: EIA Data
U.S. Distillate Fuel Oil Net Imports

Source: EIA Data

Source: EIA Data
Profitability in Refining and Marketing – 2007-2008
(with year-over-year change)

Source: EIA Data and EPRINC Calculations
U.S. Retail Prices: Gasoline vs. Diesel
2006 - 2008

Source: http://tonto.eia.doe.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm
Real Gasoline Prices – 1919 – 2009

Real Gasoline Pump Price: Annual Average 1919-2009

Source: EIA

Short Term Energy Outlook November 2008