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Energy Market Turmoil

Oil & gas remain “king” of the energy domain

Perceived vs. real supply affects energy price

Perceived supply & price movement affect alternative (supplemental / renewable) energy viability

GHG legislation will impact normal market forces

Other factors affecting normal market forces

Prognosis for capital projects
Limited Oil Supply?

- There is finite volume of total oil (and gas)
- Some disagreement as to how much is recoverable and at what price
- 30.4 billion bbl/yr global oil consumption*
- Hubbert “peak oil” equation** indicates:
  - 40 billion bbl remains in US (70% imported)
  - 1.4 trillion bbl total in world
  - excludes protected areas, oil sand, oil shale

* U.S. consumption = 7.08 billion bbl/yr; USEIA, May 09
**World Oil, April 2009, pgs 107-111
Supply Forecast - 1953

Figure 2. Future sources of distillate fuels (Ayres, E., Coal Age, August 1953, p. 70).
Oil Supply Affected by Oil at Risk

[Map of global locations with circles indicating areas affected by oil at risk, labeled as Oil and Gas]
U.S. Energy Consumption by Source – 2007*
## How is Energy Consumed?

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>POWER</th>
<th>TRANSPORT</th>
<th>HEAT</th>
<th>FEEDSTOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oil</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Coal</td>
<td></td>
<td>X</td>
<td></td>
<td>X*</td>
</tr>
<tr>
<td>Solar/ PV</td>
<td>X**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>X**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Biomass</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Geothermal</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Wave/Hydro</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Industrial Gasification  ** Supplemental Only
July 2008 – Remember This?
Chart used with permission from Kevin J. Lindemer LLC
Where Did the Money Go?

June 2007: average of $45/bbl

July 2008: average of $140/bbl

December 2008: $51/bbl

Where did the $89/bbl go?

• reduced producer windfall profit $34/bbl
• increased surplus capacity (4 mm bpd) $18/bbl
• U.S. dollar currency debasement $27/bbl
• futures / hedging $10/bbl

Source: http://trendlines.ca/monthlyreport.htm
What Should the Price Be?

- Lowest cost producer sets both floor and ceiling on price – in an unconstrained free market
- 70+% of oil reserves owned by NOC providing the major source of “GDP” for those countries
- Extraction cost is from $9 - $45 /bbl with average of $25; increases by about 1.2% annually.
- Price setting driven by more than extraction cost, transport and refining
- Traditionally prices center about a “sustainable” price range
Low Cost Producer = Saudi Arabia*

- Allocated 8 mm bbl/day production by OPEC
- Nominal $9-$11 bbl to produce
- Saudi needs $41/bbl to run its country and pay down national debt (@ 8 mm bbl/dy)
- Need additional $18/bbl to pay for $40 b in capital and infrastructure projects; $3/bbl for debt service
- Wants $65-$70; settle for $55 = $30b capital funds
- $60-$68 gets 15% ROR in US, Nigeria, Brazil, Angola on $1.5 b

* Source: Oil & Gas Journal; Feb 2, 2009 , pg 20.
• High cost production shut-in
• Demand destruction due to Cost
• NOC assert control over reserves

Region of Sustainability
For Oil Price

• Alternative Energy Attractive
• New exploration delayed
• NOC seek investment & technology
• major “shut-in” of production
Domination of Existing Energy Sources

Fuels = Oil
Power = Gas, Coal, Nuclear

- Oil Sand
- Solar/PV
- Wind
- CTL
- GTL
- Oil
- Coal
- Nuclear
- Gas
- Hydro

Coal gets $1/gal credit

Range of Sustainable Energy Cost Based on Oil

Current oil price

Adjusted $ / BOE

Portion of US Energy Consumption

Domination of Existing Energy Sources

Range of Sustainable Energy Cost Based on Oil

Current oil price

Adjusted $ / BOE

Portion of US Energy Consumption
The lowest cost/bbl project will always be the lowest cost project regardless of the price of oil.

Increasing oil prices creates dilemma of prospect for higher product margins vs. ability to finance projects to make product.

Rising price of oil may justify a higher cost/bbl project but makes the lowest cost producer more profitable and will not cause capital monies to leave lower cost projects and flow to the higher cost project.
**Alternatives (Supplementals) to Existing Sources?**

- Oil and gas remain “king” until their respective long-term market cost (FOB market-user) becomes higher than alternative source for same use.
- Coal & nuclear face “contrary” public perception
- Alternatives do not enjoy same economy of scale as oil
- Government incentives, credits, loans for alternatives means higher prices for all energy consumers.
- GHG regulations will effectively increase oil & gas cost/BOE
- Politics will affect which “supplemental” win out over each other- e.g. corn lobby.
Alternatives to Support ½ U.S. Energy Use?

- U.S. uses 2X power per capita than Europe;
- 280 kwhr per day per person
- Supporting ½ that demand equally from by 3 supplemental sources:
  - Wind farm = 2X size of California (400 fold increase)
  - Nuclear = 525 gigawatts (200+ plants)
  - Solar/photo voltaic sites = 42,200 sq. mi. (IN,KY,MS)
- Only while sun shines and wind blows
- Alternatives will not challenge oil, gas or coal for 2 generations
- Provide diversity to off-load traditional sources
Can We Afford Subsidized Alternative Fuels?

- Raise renewable usage at expense of oil and gas
- Eliminate tax preferences that encourage over production
- 2007 subsidies*: $0.82 – electric; $7.16 – solar; $6.87 – wind
- 5% less consumption of oil and gas
- 2.93 quads in less oil/gas but increased renewables
- $17.6 billion in subsidies in that year

* Per mm Btu
Global Warming Explained

IPCC votes YES; NIPCC votes NO
“Inconvenient Truth” vs. ‘Great Global Warming Swindle”

“Of several acceptable explanations for a phenomenon, the simplest is preferable”
- Ockham’s Razor  (William of Ockham – 14th century)
“Respect those who seek the truth;
Be wary of those who claim to have
found it”

– Mark Twain
# Capital Project Market

## Economic Impact Varies by Segment

- **Infrastructure remains strong globally**
- **Metals & Mining linked directly to metal price**
  - Gold, silver, nickel, lead, copper
  - Base metals affected by reduced demand
- **Power remains strong – “rust” factor**
- **Chemical & Petroleum heavily impacted by energy price and demand reduction.**
What Has Happened to Project Activity?

% Change from 1Q2007

-20 -15 -10 -5 0 5 10 15 20 25 30

4Q06 3Q07 2Q08 1Q09 4Q09 3Q10 2Q11 1Q12 4Q12 3Q13 2Q14
<table>
<thead>
<tr>
<th>Underlying Fundamentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>People still want homes and cars</td>
</tr>
<tr>
<td>Energy demand continues to grow at 1.2-1.4% annually on a global basis</td>
</tr>
<tr>
<td>We exist in a global community market with 6.5 billion – 5.5 billion wanting what we have</td>
</tr>
<tr>
<td>Energy facilities and infrastructure are aging – the “rust” factor</td>
</tr>
<tr>
<td>“Carbon Management” is here to stay</td>
</tr>
</tbody>
</table>
Implications to Energy Projects

- Projects must be built – un-met demand is increasing (NOC=$277b; IOC= $100 b)*
- Projects will be executed to “green-up” existing operations
- Alternatives will be built to diversify sources
- Slight increase in cost of services and materials**
- Severe shortage of resources to undertake the resurgence.
- Funding is available based upon risk profile

* Oil & Gas Journal, pg. 16; June 8, 2009  
** Nelson-Farrar Cost Index  pennnet.com
Challenges Looking Ahead

- Availability of skilled personnel
- Aging Infrastructure: replace or fix?
- New oil & gas reservoirs = sustainable prices
- Government intervention vs. incentives
- Economic downturn impact on global consumption vs. underlying demand growth
- Alternative energy sources: at what energy price
- Energy markets are global and complex
- Corporate Boards have long memories and will seek protection against runaway costs and risk
Conclusions

- Alternative energy sources will expand due to mandates, credits, subsidies vs. market forces
- All energy costs will increase causing a focus upon efficiency and conservation
- A “sweet-spot” may put energy @ $65-$75 BOE (2008)
- The gap in capacity “closure” between existing and alternative is a generational time frame.
- All forms of energy should be developed to “off load” the existing sources but in a safe, carbon and GHG footprint manner that is constantly improving.
- There will be a slow resurgence in capital projects
- Global “carbon” program needs global participation
Global Economy is fueled by Energy

THE STONE AGE DID NOT END BECAUSE THEY RAN OUT OF ROCKS . . .

- AUTHOR UNKNOWN
Intellect distinguishes between the possible and impossible;

Reason distinguishes between sensible and senseless.

Even the possible can be senseless.

Max Born