Is Kentucky Prepared For A Pending Energy Storm?

University of Kentucky
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Lexington, KY
By
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Chairman
Simmons & Company International
Why We Now Face An Energy Storm

- Demand too young and growth unstoppable.
- Supply got too old and is starting to decline.
- Oil infrastructure too rusty and old.
- Other sources of energy all face challenges.
- Few address mobility, which was the genius of oil.
We Also Ran Out Of “Nails” To Drill More Wells

- Data on “rig” and other oil service assets is skimpy.
- Data ranking asset quality is non-existent.
- Oil service/drilling industry supported by massive employee base:
  - Demographic data is poor
  - Data on number of key personnel nearing retirement also skimpy
- For increases in oil supply to occur, world needs far more rigs.
- But, out “rigs” are too rusty and too old.
These Issues Would Not Be Serious If They Were Not About Energy

- Many commodities have cycles.
- Often high prices lower demand and boost supply.
- Most commodities have many substitutes.
- Energy is different and enormously important.
- “We” fell asleep at the energy wheel.
- But the seeds to crisis were planted years ago.
Modern Energy Makes The World Work

- Modern energy creates virtually all aspects of our society:
  - Technology
  - Healthcare
  - Mobility
  - Heating, cooling, lighting
  - 90% of food supply
  - Potable water

- It grew to be world’s largest industrial activity.

- We still use 3 primary energy sources:
  - Oil 40%
  - Coal 20%
  - Natural Gas 20%
  - Nuclear, Hydro, etc. 20%

Fossil Fuels
Fossil Fuel Energy Was 20th Century Miracle

- In 1900, “we” used no natural gas, little oil and tiny amount of coal:
  - Oil was used most in production of Vaseline
  - Coal-produced gas lit up our cities

- U.K. was King of Coal: The key to the industrial revolution.

- Rest of the world used manual labor, animals, wind, wood and dung.

- Over next 100 years, every modern miracle was possible because modern fossil fuel energy grew.
Horse manure and dead animals spread virulent disease.

Smog caused by dirty coal and wood smoke blanketed London.

Non-industrial countries cut down precious trees for fuel.

Air, water, streets and houses existed in a very dirty environment.
Oil use grew over 100 fold.

Natural gas use began 30 – 40 years later and grew even faster.

Electricity spread around prosperous world.

Atomic energy was only new energy created in 20th century.

Technology, food, healthcare, globalization, clean air and water are all by-products of the hydrocarbon era.
20th Century: The Hydrocarbon Era
Most Energy Use Is Still Concentrated In Industrial Nations

Disparity highlights world’s vast rich/poor gap.

<table>
<thead>
<tr>
<th>% Use of World's Primary Energy</th>
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<tbody>
<tr>
<td>OECD Countries 49%</td>
</tr>
<tr>
<td>China 15%</td>
</tr>
<tr>
<td>Russia 6%</td>
</tr>
<tr>
<td>India 5%</td>
</tr>
<tr>
<td>Brazil 2%</td>
</tr>
<tr>
<td>Rest of the World 23%</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Consumption by Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIL</td>
</tr>
<tr>
<td>2001 (projected)</td>
</tr>
<tr>
<td>2010 (projected)</td>
</tr>
<tr>
<td>25 million barrels a day</td>
</tr>
<tr>
<td>2,000 million short tons</td>
</tr>
<tr>
<td>30 trillion cubic feet</td>
</tr>
<tr>
<td>COAL</td>
</tr>
<tr>
<td>2001 (projected)</td>
</tr>
<tr>
<td>2010 (projected)</td>
</tr>
<tr>
<td>USA</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
</tr>
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</tbody>
</table>

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The World’s Need For Energy Is Inexhaustible

- Over next 24-years, energy use grew by 54% or 79 million BOE/day.
- 24-years from now, energy use estimated to grow to 342 million BOE/day.
- This growth is 81% of entire global energy use in 1980.

Source: IEA World Energy Outlook 2006
Rise In Oil Price Has Defied All Odds

July 1, 2004: Yamani Energy Summit: “Is $40 oil a crisis or an aberration?"

April 15, 2006: $75 oil.

January 20, 2007: Oil falls to $50. It has peaked!

November 8, 2007: Asian oil prices top $101 per barrel.
Why Are Oil Prices So High?
(According To The Houston Chronicle)

- “Iraq War Premium” = $10 (when oil was $40 per barrel).
- “Speculators and hedge funds” = $10 – $15 per barrel premium (last four years).
- Weak dollar added $17 per barrel.
- “Fear factors created price spike of $30 – $40.”
- “Fundamentals” argue for much lower prices (last four years).
- “The market is well serviced, prices should not be so high.”

Source: Graphic by Jay Carr.
Copyright 2007 Houston Chronicle.
What The Real Fundamentals Say

- Rising oil demand fooled everyone.
- Demand growth seems insatiable.
- Oil supply woes became pandemic.
- Technology created accidental just-in-time supply.
- Too many oil basins peaked.
- Stock (inventory) liquidation became last gasp supply.
How Strong Is Oil Demand Growth?

- **Bigger than anyone thought:**
  - 1990 – 1995: “Oil demand has probably peaked”
  - Post 9/11: Oil demand growth over

- **What really happened:**
  - 1995 – 2007: Oil demand grew by 16 million barrels per day
  - 4thQ 2007 – 1stQ 2008: Oil demand projected to hit all time high
Was Oil Demand Surprise Just Missing China?

Close examination of why demand grew:

Oil Demand Outside OECD Growing Everywhere
- Driven by rapid population growth.
- Far more vehicles.
- Improving economies.

<table>
<thead>
<tr>
<th>Country</th>
<th>2001</th>
<th>2006</th>
<th>Change</th>
<th>5-Year Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>0.54</td>
<td>0.69</td>
<td>+0.15</td>
<td>+17%</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.45</td>
<td>0.51</td>
<td>+0.06</td>
<td>+13%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.25</td>
<td>0.29</td>
<td>+0.04</td>
<td>+16%</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.44</td>
<td>0.65</td>
<td>+0.21</td>
<td>+14%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>0.57</td>
<td>0.66</td>
<td>+0.09</td>
<td>+16%</td>
</tr>
<tr>
<td>India</td>
<td>2.29</td>
<td>2.58</td>
<td>+0.29</td>
<td>+13%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.13</td>
<td>1.32</td>
<td>+0.19</td>
<td>+17%</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.67</td>
<td>0.96</td>
<td>+0.29</td>
<td>+27%</td>
</tr>
<tr>
<td>China</td>
<td>4.67</td>
<td>6.69</td>
<td>+1.02</td>
<td>+43%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>1.65</td>
<td>1.99</td>
<td>+0.34</td>
<td>+21%</td>
</tr>
<tr>
<td>Total Non-OECD</td>
<td>29.15</td>
<td>33.35</td>
<td>+4.20</td>
<td>+16%</td>
</tr>
</tbody>
</table>

OECD Oil Demand Has Been A Mixed Bag (Many Moving Parts)

<table>
<thead>
<tr>
<th>Selected Country Sample</th>
<th>2001</th>
<th>2006</th>
<th>Change</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>19.97</td>
<td>21.03</td>
<td>+1.06</td>
<td>+5%</td>
</tr>
<tr>
<td>Canada</td>
<td>2.06</td>
<td>2.23</td>
<td>+0.17</td>
<td>+8%</td>
</tr>
<tr>
<td>Austria</td>
<td>0.26</td>
<td>0.30</td>
<td>+0.04</td>
<td>+15%</td>
</tr>
<tr>
<td>France</td>
<td>2.05</td>
<td>1.96</td>
<td>(0.09)</td>
<td>-4%</td>
</tr>
<tr>
<td>Germany</td>
<td>2.81</td>
<td>2.66</td>
<td>(0.15)</td>
<td>-5%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.89</td>
<td>1.01</td>
<td>+0.12</td>
<td>+13%</td>
</tr>
<tr>
<td>Spain</td>
<td>1.49</td>
<td>1.59</td>
<td>+0.10</td>
<td>+7%</td>
</tr>
<tr>
<td>UK</td>
<td>1.74</td>
<td>1.83</td>
<td>+0.09</td>
<td>+5%</td>
</tr>
<tr>
<td>Japan</td>
<td>5.39</td>
<td>5.16</td>
<td>(0.23)</td>
<td>-4%</td>
</tr>
<tr>
<td>Australia</td>
<td>0.87</td>
<td>0.92</td>
<td>+0.05</td>
<td>+6%</td>
</tr>
<tr>
<td>Total OECD</td>
<td>47.90</td>
<td>49.22</td>
<td>+1.32</td>
<td>+3%</td>
</tr>
</tbody>
</table>
What Is Driving Oil Demand Growth?

Mobility and Prosperity

Mobility

Growth In Oil Use Seems Inexhaustible

  - Estimates range by various scenarios
  - All end up with oil demand = 115 to 125 million Bbls/day in 2025.
- Disparity of vehicles drives this growth:

<table>
<thead>
<tr>
<th>Region</th>
<th>Population</th>
<th>No. of Vehicles</th>
<th>Vehicles per 1,000 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>437</td>
<td>260</td>
<td>641</td>
</tr>
<tr>
<td>Western Europe</td>
<td>502</td>
<td>252</td>
<td>472</td>
</tr>
<tr>
<td>OECD Pacific</td>
<td>530</td>
<td>62</td>
<td>462</td>
</tr>
<tr>
<td>OECD Total</td>
<td>1,489</td>
<td>224</td>
<td>504</td>
</tr>
<tr>
<td>FSU/Eastern Europe</td>
<td>314</td>
<td>62</td>
<td>162</td>
</tr>
<tr>
<td>Developing Economies - China</td>
<td>1,314</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>3,678</td>
<td>184</td>
<td>51</td>
</tr>
</tbody>
</table>

Prosperity

FIGURE ONE: 2007 GDP GROWTH FORECASTS BY COUNTRY PERCENTAGE YEAR ON YEAR

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP Growth 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>8.9</td>
</tr>
<tr>
<td>Vietnam</td>
<td>7.5</td>
</tr>
<tr>
<td>India</td>
<td>7.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>6.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>6.0</td>
</tr>
<tr>
<td>Malaysia</td>
<td>5.8</td>
</tr>
<tr>
<td>Philippines</td>
<td>5.6</td>
</tr>
<tr>
<td>South Korea</td>
<td>4.0</td>
</tr>
<tr>
<td>Singapore</td>
<td>4.4</td>
</tr>
<tr>
<td>US</td>
<td>3.1</td>
</tr>
<tr>
<td>Euro Zone</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: OPEC's World Oil Outlook 2007 (2007 data)
How High Can Oil Demand Grow?

- There is no glass ceiling.
- Best experts predict oil demand exceeding 115 mmb/d by 2020.
- 115 – 130 mmb/d still leaves India and China as energy paupers.
- High prices do not kill demand.

But, oil use can never exceed oil supply.
What Do We Know About Oil Supply?

- Non-OPEC supply petered out.
- OPEC excess capacity got used up.
- Crude oil growth is falling behind petroleum demand.
- Decline rates remain a mystery but are too high.
- Petroleum stocks are enormous but primarily “line pack.”
If Oil Demand Growth Is Unstoppable And Supply Is Faltering, What’s Next?

- Peak Oil is a serious issue.
- Oil stock liquidation is non-sustainable supply.
- Growth in natural gas liquids is non-sustainable supply.
- Non-conventional oil does not work:
  - Expensive
  - Low flow rates
  - Energy intensive
  - Low quality crude

Source: CJ Campbell – ASPO IV International Workshop on Oil & Gas Depletion
Has Peak Oil Arrived?

- EIA data quietly says, “Yes.”
- Energy Watch Group* says, “Yes.”
- Dr. Sadad Al-Husseini says, “Yes.”
- Boone Pickens says, “Yes.”
- ASPO China creation endorsed, “Yes.”

Many “yes” votes are weeks old.

*Energy Watch Group – an independent German consulting firm reports to Parliament.
Why EIA Crude Oil Production Has Slipped

- Only a few key producers grew in last 27 months.
- Too many large producers declined.
- Few “advancers” have much advance left.
- Most decliners see decline accelerating.
- Overcoming a 1.7 MMB/D gap is stiff challenge.

What Peak Oil Nay Sayers Say

- Global oil reserve endowment plentiful (3 to 10 trillion barrels).
- Oil reserve appreciation creates far more oil.
- Oil field technology advances make oil easier to find and produce.
- Non-conventional oil resources are vast.
- Yet-to-find oil is vast.
- High prices unlock more oil supply.

All these are faith based beliefs, none have any supporting data.
What Energy Watch Report Said

- Oil supply peaked in 2006.
- “The most important finder is the steep decline of oil supply after peak”:
  - 2006: 81 mmb/d
  - 2020: 58 mmb/d
  - 2030: 39 mmb/d
- This crisis leads to war.

Source: Energy Watch Group: “Crude Oil the Supply Outlook"
Peeling Back The Energy Watch Study

A picture is worth a thousand words:

Source: Energy Watch Group: “Crude Oil the Supply Outlook”
Peeling Back The Energy Watch Study (Part II)

A picture is worth a thousand words:

- **Figure 9: Oil production in OECD North America**
- **Figure 42: Field by field analysis of the oil production in Alaska**
- **Figure 31: Oil production in Canada**
- **Figure 39: Oil production in OECD Pacific**

Source: Energy Watch Group: “Crude Oil the Supply Outlook”
Peeling Back The Energy Watch Study (Part III)

A picture is worth a thousand words:

Source: Energy Watch Group: “Crude Oil the Supply Outlook”
Oil and Money presentation on October 30, 2007 (Tuesday):

- “The top 38 giant fields of Arabian Gulf are in total 41% depleted”

Remaining reserves = ≈360 billion barrels.

Critical “leading edge” technologies are up against complex reservoirs.

At least 300 billion barrels reported reserves are political barrels.
Summary Of Dr. Sadad Al-Husseini’s Assessment

Conclusion: The global oil outlook needs detailed scrutiny

North America:
Canadian tar sands are important but declines in Mexico and the US are irreversible

South America:
Offshore Brazil oil and Venezuelan EHCs are important but the offshore fields are smaller and there are offsetting declines in S. America

Europe / North Sea:
The North Sea has peaked and is in rapid decline

FSU / Caspian:
A revitalized industry in the FSU open to investors may sustain high production through 2030

The Arabian Gulf has the resources but regional turmoil and execution issues undermine growth.
Dr. Sadad Al-Husseini’s Conclusion

This represents “best case” as it assumes all new projects are successful.
What The EIA Is Advertising

“When the world is not running out of oil -” but it does face “the end of the abundant and cheap oil on which all industrial nations depend.”

Colin J. Campbell and Jean H. Laherrere, 1998
Scientific American

When Will the World’s Oil Production Peak?
Energy Information Administration

When will world production peak? EIA’s short answer is not soon, but within the present century. A peak in world oil production is decades away...not years away.

(Guy Caruso, Administrator
United States Energy Information Administration, DOE, 2005)
What The EIA Data Says

Fig 1: Incremental Crude Barrels 2001 - Aug 2007


Data source: EIA International Petroleum Monthly

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How High Can Oil Prices Go?

- $100 mmb/d = $.15 per cup.
- Consumers in Europe, Australia and New Zealand have been paying $250 - $300 per barrel for oil.
- Oil was a miracle product:
  - Created transportation fuel that traveled
  - Created global prosperity
- We used most of our highest quality of oil at two cents per cup.
How Important Is Peak Oil?

- If crisis is ignored, it leads to social chaos.
- If Peaking is past tense, we ran out the clock for easy transition resolutions.
- The wolf is inside the house.
- The 500 pound elephant just sat on our chest.

“I’m right there in the room, and no one even acknowledges me.”
How Quickly Could The Crisis Play Out?

- Demand exceeding supply is draining oil stocks.
- Breaching “minimum operation levels” leads to shortages (somewhere/sometime).
- Absent rationing system, shortages lead to user hoarding.
- Hoarding creates “run on the bank.”
- “Empty tanks” could occur in less than a week.
Is Peak Oil Our Greatest Challenge?

- Global Warming pales in comparison in immediate devastation impact.

- We have no “Plan B” to address ending our addiction to oil.

- Could greater challenge be limits to natural gas, coal, uranium and potable water?

“We” fell asleep at the global wheel!
No Current “Other Energy” Source Substitutes Oil

- Natural gas is world’s only super-efficient heat source.
- Coal, nuclear, hydro, wind and solar create electricity.
- All these sources face limits to either growth, scalability or steady supply.
- Biofuels upset our food chain and water supply.
- Electricity is highly inefficient heat source.
We Need “Plan B” Urgently

- World faces greatest risk to sustain 21st century as oil peaks (and natural gas, too?)

- R&D revolution needs to investigate ways to invent new energy sources:
  - Oceans?
  - Space?
  - Earth’s interior?

- New conservation standards need to be mandated (like rationing in World War II):
  - Liberate work force = end long-distance commute
  - Grow food locally
  - Produce goods locally

ALL of the above
Kentucky, Like America, Like The World, Needs A “Plan B”

- Peak Oil is real. Kentucky needs to plan for it.
- Kentucky’s energy sources have their own unique limits:
  - Natural gas probably scarce and declines faster than oil (vapor vs. liquid)
  - Coal has fuzzy resource data and environmental issues
  - Ethanol for corn turned out to be an unwise idea:
    - Too energy and water intensive
    - Low BTU value and corrosive
- Kentucky (like America and the world) has a rusty energy infrastructure badly in need of rebuilding.
- Plan B has to primarily address conservation.
Kentucky’s Water Access Creates Energy Conservation

- Moving goods, people and energy by water saves massive oil use.
- Barge travel can exceed long-distance road hauls by 10 to 30 times.
- River currents could also be tapped for more electricity:
  - Current – water energy still in infancy
- America’s rivers are 21st century’s super-highways.
How Sustainable Is Kentucky/Appalachian Basin Coal?

- Coal resource data not much better than Middle East Oil.
- Too many reserve estimates are “stale” and essentially volumetric in nature.
- “Black coal” is a diminishing global supply.
- Brown coal contains low BTU/ton value.
- Coal needs to remain key source for electricity:
  - Coal-to-liquids is expensive and energy intensive.
Kentucky Is One Of America’s Few Energy Exporters

- Only four U.S. states produce more “surplus energy”:
  - Wyoming (coal, oil and natural gas)
  - Alaska (oil)
  - West Virginia (coal)
  - New Mexico (oil and coal-bed methane)

- Most American states are “energy parasites” (i.e. are energy deficient):
  - California
  - Florida
  - New York
  - Ohio
How Does Kentucky Address Peak Oil And Gas Issue?

- No Plan B (but nobody else does either);
- State is lucky to be major energy exporter.
- State is fortunate to have Ohio River Waterway and TVA “nearby.”
- State has no proof of any meaningful oil and gas (but deep exploration “nascent”).
There Is Twilight In The Desert

- Era of boundless, cheap energy is over.
- Likely decline of quality oil is at hand (or past tense).
- How world responds to this challenge might make solving World War II look simple.

The time to act is NOW! Take Peak Oil seriously!
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Investment Bankers to the Energy Industry

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