Is Oil's Future Sustainable?

If Not, What Are The Consequences?

Dallas Committee on Foreign Relations - Dallas, TX
January 14, 2009
By:
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Simmons & Company International

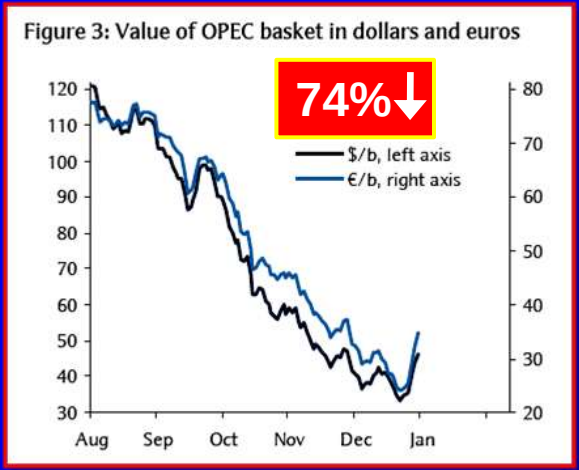
2008: Oil's Annus Horribilis

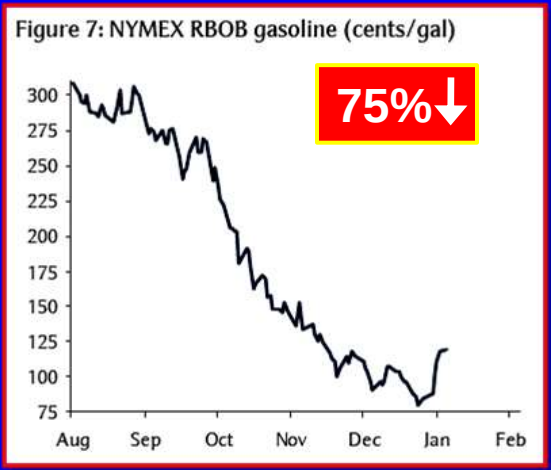
- 2008 started out so "bright" for oil markets:
  - Rigs were fully employed
  - Oil price was high but not exorbitant
  - Oil regions were booming
- But, then came "volatility":
  - Prices spiked from $96 to $147 by early July (+53%)
  - Prices took a breather through mid-September
  - Then, prices plunged 74% in next 3 months

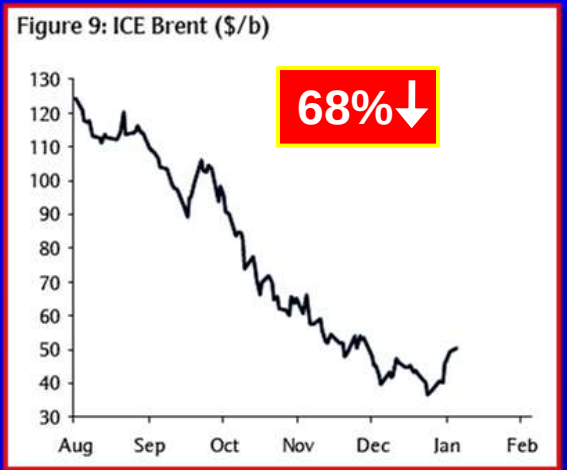
"1992 is not a year on which I shall look back with undiluted pleasure. In the words of one of my more sympathetic correspondents, it has turned out to be an 'Annus Horribilis'. I suspect that I am not alone in thinking it so. Indeed, I suspect that there are very few people or institutions unaffected by these last months of worldwide turmoil and uncertainty."

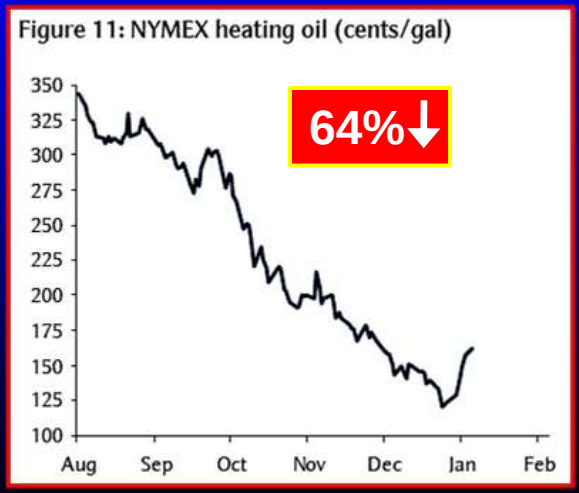
A Picture Is Worth A 1,000 Words

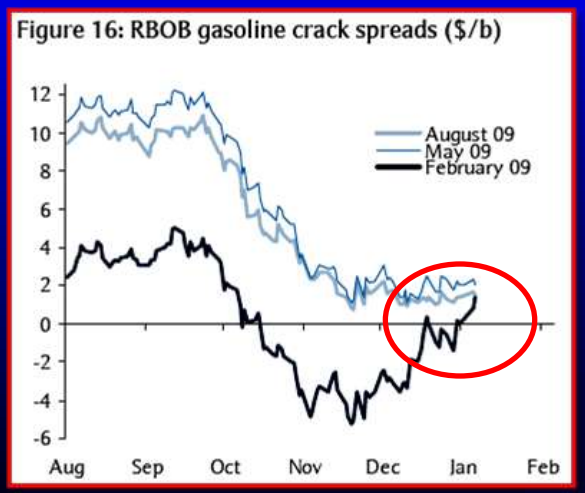
- "When crude falls, it seems to drag other oil production in its wake."

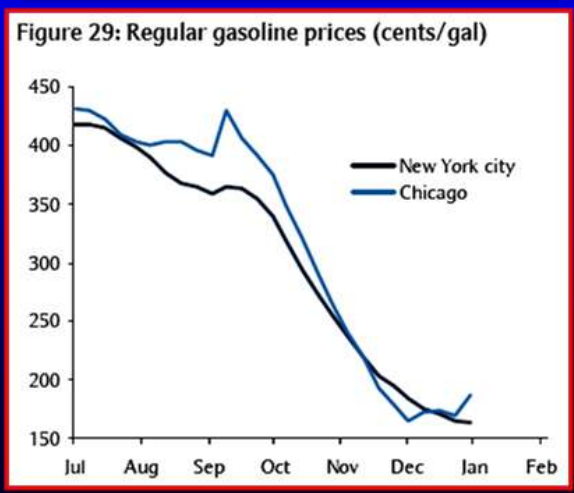












Source: Barclays Capitol – Weekly Oil Data Review, January 7, 2009

The Big Question As 2008 Came Crashing To An End

- Why did prices spike so high?
- Why did oil prices then crash?
- Many pundits answered by observing:
  - Prices spiked because of speculation
  - Prices collapsed because:
    - Speculators went AWOL
    - Oil demand began to plunge
    - Oil gluts quickly emerged

The Spike And The Collapse Were Asymmetric

- The “spike” topped off a 15 fold increase from under $10 in 1998 to $147 in 2008.
- The 3 month plunge took oil price back to where they were in November 2003.
- Were both anomalies? Will we ever know?

What Is A Fair Price For Oil?

- Oil prices will stay at $5 for decade or two.
  (The Economist cover story March, 1999)
- "$27 oil price is fair."
  (Lord Brown of British Petroleum – October, 2004)
- "$30 - $45 oil price is fair."
  (Shell's John Huffmeister – January 6, 2008)
- "$75 oil price is fair."
  (King Abdullah of Saudi Aramco – December 2008)

Maybe oil is so plentiful that it has no fair price!

Multiple Quiz

- ❑ Fools Gold?
- ❑ Just another commodity?
- ❑ World's most precious natural resource?

Nothing Goes Straight Up!

- Oil price 15 fold rise had many retracements.
- But each dip soon became a new high.
- These are “normal prices.”
- When inflation adjusted (CPI) the picture altered.

Some Interesting Price* Benchmarks (Or Milestones?)

		CPI Adjusted to 2008
The 1990s		
Oil price at start of 1990	= $22.91	$38.28
Low price (12/1/98)	= $11.30	$14.64
High price (10/1/90)	= $36.13	$57.50
1st 7 Years of 21st Century		
January 2000	= $27.22	$34.26
Low price (12/1/01)	= $19.31	$23.22
High price (6/1/08)	= $133.93	$131.25

*Using nominal price at beginning of each month over last 18 years.

Why Did Prices Rise 15 Fold In A Decade?

- 1997 – 2007 fundamentals changed:
  - Demand grew by 12.7 MMB/D
  - Crude oil production grew by 7.3 MMB/D
  - Gap was filled by:
    - Increased natural gas liquids
    - "Other liquids"
    - Refinery processing gains
    - Occasional stock liquidation

- OECD total petroleum stocks:
  12/1997: 2,615 million (56 days use)
  12/2007: 2,566 million (52 days use)
- Along the way, speculators often shorted oil contracts.

Why Did Crude Supply Not Keep Pace With Demand Growth?

- E&P spending grew from less than $100 billion to $400 billion in the decade.
- By 2008, every quality drilling rig (and other oil service assets) were being used.
- Technology gains allowed deepwater/ultra deepwater exploration.
- Seismic advances and reservoir simulation modeling allowed greater amounts of trapped oil to be drained.

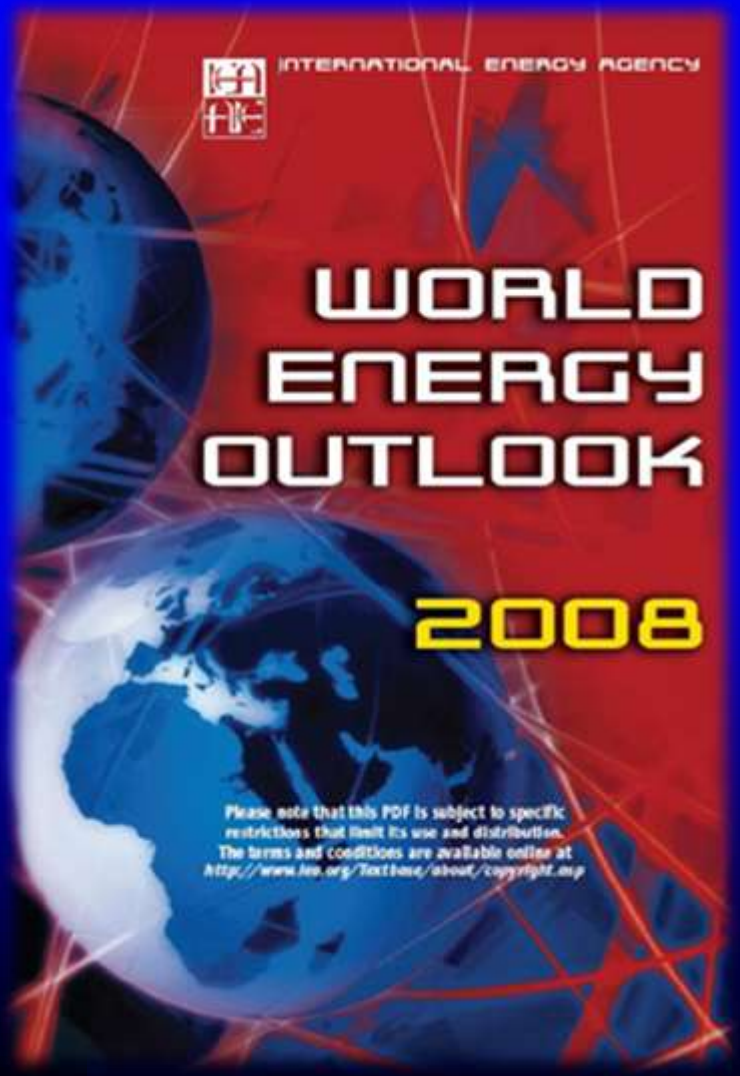
But, all this still created “flattening” of crude oil supply in last few years.

Did Oil Field Technology Not Work?

- If so many new wells drilled and so much money spent, was it wasted?
- No. These projects were critical to offset accelerating decline rates from mature fields.
- The big problem:
  - All new discoveries were either small or in deepwater
  - All peak fast and decline fast

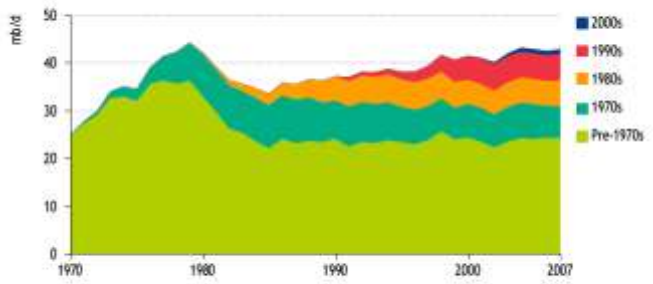
Long-Term Supply Trend Got Uglier By The Year

- >800 super-giant, giant and large oil fields comprise 58% of world's crude supply.
- Other 42% comes from ≈70,000 small to tiny fields (average field production 440 bbls/day.
- Foundations of world's oil supply comes from 356 super-giant oil fields. Almost all are "mature" and past peak.
- IEA's WEO 2008 Supply Outlook laid bare some ugly facts.



“The Era Of Cheap Oil Is Over” (IEA November 14, 2008)

Figure 10.1 • World crude oil production from super-giant and giant fields by field vintage



Note: For fields covered by IEA field-by-field oil production database (which includes all the world's super-giant fields and most giant fields). Fields are classified according to the year of first production.

Sources: IHS and Deloitte & Touche databases; other industry sources; IEA estimates and analysis.

Figure 11.1 • World oil production by source in the Reference Scenario

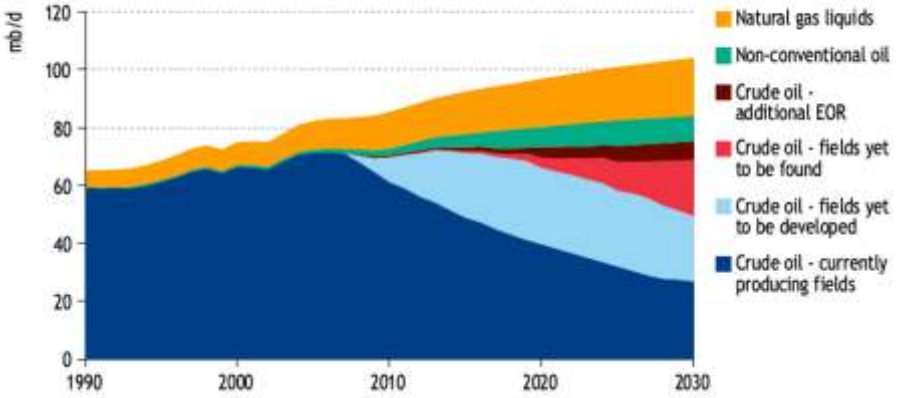


Table 10.1 • The world's 20 biggest oilfields by production

Field	Country	Location	Year of discovery	Peak annual production		2007 production
				Year	kb/d	kb/d
Ghawar	Saudi Arabia	Onshore	1948	1980	5 588	5 100
Cantarell	Mexico	Offshore	1977	2003	2 054	1 675
Safaniyah	Saudi Arabia	On/off	1951	1998	2 128	1 408
Rumaila N & S	Iraq	Onshore	1953	1979	1 493	1 250
Greater Burgan	Kuwait	Onshore	1938	1972	2 415	1 170
Samotlor	Russia	Onshore	1960	1980	3 435	903
Ahwaz	Iran	Onshore	1958	1977	1 082	770
Zakum	Abu Dhabi (UAE)	Offshore	1964	1998	795	674
Azeri-Chirag-Guneshli	Azerbaijan	Offshore	1985	2007	658	658
Priobskoye	Russia	Onshore	1982	2007	652	652
Top 10 total						14 260
Bu Hasa	Abu Dhabi (UAE)	Onshore	1962	1973	794	550
Marun	Iran	Onshore	1964	1976	1 345	510
Raudhatain	Kuwait	Onshore	1955	2007	501	501
Gachsaran	Iran	Onshore	1928	1974	921	500
Qatif	Saudi Arabia	On/Off	1945	2006	500	500
Shaybah	Saudi Arabia	Onshore	1968	2003	520	500
Daqing (Daqing)	China	Onshore	1960	1993	633	470
Samotlor (Main)	Russia	Onshore	1961	1980	3 027	464
Fedorovo-Surguts	Russia	Onshore	1962	1983	1 022	458
Zuluf	Saudi Arabia	Offshore	1965	1981	677	450
Top 20 total						19 163

Sources: IHS, Deloitte & Touche and USGS databases; other industry sources; IEA estimates and analysis.

Table 10.7 • Number of oilfields in dataset for decline rate calculations

	Super-giant	Giant	Other	All fields
By location				
Onshore*	43	185	159	387
Offshore shelf	11	61	147	219
Offshore deepwater	0	17	28	45
By lithology				
Carbonate	32	69	59	160
Sandstone	22	189	268	479
Chalk	0	5	7	12
By grouping				
OPEC	40	97	48	185
Middle East	33	41	8	82
Other	7	56	40	103
Non-OPEC	14	166	286	466
By region				
OECD	3	68	150	221
North America	3	43	56	102
Europe	0	22	89	112
Pacific	0	2	5	7
Non-OECD	51	195	184	430
E. Europe/Eurasia	10	52	14	76
Asia	1	19	73	93
Middle East	33	50	18	101
Africa	1	40	53	94
Latin America	6	34	26	66
Total	54	263	334	651

* Includes fields partially offshore. The dataset includes all post-peak fields in our database.

Sources: IHS, Deloitte & Touche and USGS databases; other industry sources; IEA estimates and analysis.

Has Crude Oil Now Peaked?

- Hard data argues that sustained peak supply reached in 2005.
- Too many key producing countries are now in irreversible production decline.
- Only a handful of key producers have some growth left:
  - Angola
  - Brazil
  - Sudan (?)
  - Canada's heavy oil (?)

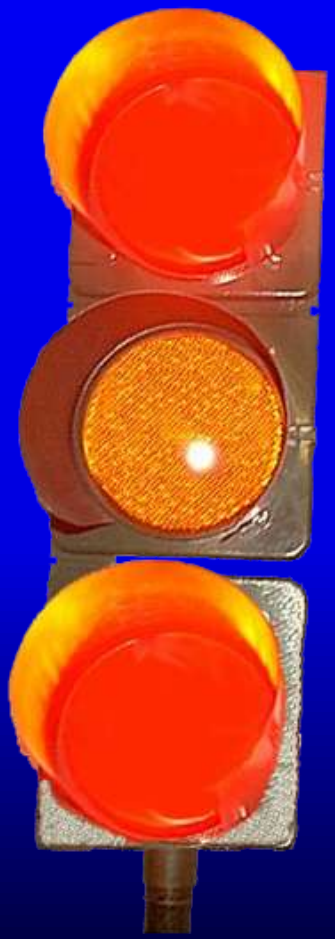
Table 11.1b World Crude Oil Production: Persian Gulf Nations, Non-OPEC, and World (Thousand Barrels per Day)

	Persian Gulf Nations[b]	Selected Non-OPEC[a] Producers									Total Non-OPEC[a]	World
		Canada	China	Egypt	Mexico	Norway	Former U.S.S.R.	Russia	United Kingdom	United States		
1973 Average	20,668	1,798	1,090	165	465	32	8,324	NA	2	9,208	24,888	66,670
1976 Average	18,934	1,490	1,490	235	705	180	9,623	NA	12	8,376	25,892	62,828
1980 Average	17,901	1,435	2,114	595	1,936	486	11,706	NA	1,022	8,597	32,802	69,668
1986 Average	9,830	1,471	2,605	887	2,746	773	11,685	NA	2,630	8,971	37,664	63,966
1990 Average	15,278	1,663	2,774	873	2,653	1,630	10,976	NA	1,820	7,355	30,822	60,492
1996 Average	17,208	1,805	2,990	920	2,618	2,766	--	6,006	2,489	8,560	35,736	62,385
1998 Average	17,367	1,837	3,131	922	2,855	3,091	--	6,860	2,508	8,466	36,682	63,762
1997 Average	18,096	1,922	3,200	866	3,023	3,142	--	6,920	2,518	8,462	37,320	65,744
1998 Average	19,337	1,981	3,198	834	3,070	3,011	--	6,854	2,616	8,362	37,466	66,966
1999 Average	18,867	1,907	3,195	862	2,906	3,019	--	6,070	2,884	8,081	37,699	66,922
2000 Average	[illegible]	1,977	3,249	768	3,012	3,222	--	6,479	2,276	8,822	38,482	68,496
2001 Average	19,098	[illegible]	3,300	720	3,127	3,226	--	6,017	2,282	8,801	39,014	68,101
2002 Average	17,794	2,171	[illegible]	716	3,177	3,131	--	7,408	2,202	8,746	39,919	67,168
2003 Average	19,063	2,306	3,409	[illegible]	3,371	3,042	--	8,132	2,093	8,081	40,724	69,448
2004 Average	20,787	2,998	3,485	673	[illegible]	2,954	--	8,805	1,846	8,419	41,687	72,612
2006 January	21,285	2,330	3,561	658	3,351	2,720	--	8,870	1,775	5,441	41,358	73,231
February	21,355	2,298	3,570	658	3,349	2,809	--	8,920	1,771	5,494	41,516	73,514
March	21,405	2,172	3,594	662	3,252	2,867	--	8,925	1,802	5,501	41,541	73,842
April	21,565	2,300	3,584	659	3,405	2,864	--	8,888	1,771	5,558	[illegible]	74,140
May	21,375	2,360	3,611	656	3,441	2,796	--	8,900	1,743	5,581	[illegible]	74,298
June	21,485	2,330	3,646	656	3,425	2,398	--	9,026	1,643	5,460	41,558	73,916
July	21,695	2,339	3,654	658	3,082	2,715	--	8,990	1,625	5,240	41,143	73,757
August	21,655	2,372	3,668	655	3,414	2,643	--	9,140	1,342	5,218	41,169	73,818
September	21,915	2,262	3,623	659	3,367	2,663	--	9,170	1,518	4,204	40,413	73,399
October	21,525	2,462	3,649	664	3,221	2,577	--	9,230	1,612	4,534	40,885	73,497
November	21,425	2,548	3,621	667	3,311	2,645	--	9,210	1,543	4,837	41,425	73,980
December	21,325	2,645	3,520	647	3,388	2,683	--	9,240	1,545	4,984	41,803	74,268
Average	21,601	2,369	3,609	658	3,334	2,698	--	9,043	1,649	5,178	41,401	73,807
2006 January	21,175	2,595	3,670	654	3,372	2,657	--	9,030	1,707	5,106	41,579	73,759
February	21,375	2,504	3,662	657	3,311	2,620	--	9,040	1,639	5,045	41,412	73,647
March	21,250	2,411	3,710	651	3,350	2,610	--	9,150	1,597	5,045	41,396	73,489
April	21,250	2,531	3,680	653	3,370	2,407	--	9,170	1,590	5,129	41,496	73,591
May	21,050	2,341	3,712	655	3,329	2,535	--	9,190	1,500	5,161	41,386	73,154
June	21,305	2,336	3,700	607	3,287	2,365	--	9,260	1,392	5,160	40,979	73,061
July	21,680	2,512	3,716	620	3,232	2,571	--	9,240	1,453	5,102	41,627	74,076
August	21,710	2,543	3,660	630	3,252	2,430	--	9,330	1,202	5,059	41,179	73,754
September	21,360	2,601	3,649	640	3,258	2,338	--	9,350	1,354	5,037	41,242	73,465
October	21,135	2,602	3,650	660	3,173	2,380	--	9,460	1,482	5,106	41,793	73,809
November	20,805	2,658	3,672	615	3,163	2,466	--	9,320	1,504	5,105	41,805	73,437
December	20,695	2,669	3,592	619	2,978	2,508	--	9,420	1,472	5,166	41,664	73,218
Average	21,232	2,626	3,673	639	3,266	2,491	--	9,247	1,499	5,102	41,464	73,639
2007 January	20,476	2,578	3,811	616	3,143	2,431	--	9,420	1,510	[illegible]5,196	41,857	73,133
February	20,356	2,618	3,739	614	3,148	2,464	--	9,460	1,654	[illegible]5,147	42,124	73,315
March	20,445	2,694	3,685	612	3,182	2,391	--	9,473	1,554	[illegible]5,178	41,993	73,240
April	20,494	2,634	3,749	609	3,182	2,427	--	9,369	1,566	[illegible]5,218	42,067	73,520
May	20,494	2,586	3,781	613	3,110	2,181	--	9,390	1,564	[illegible]5,240	[illegible]41,680	72,985
June	20,403	2,580	3,826	679	3,206	1,921	--	9,440	1,495	[illegible]5,139	41,521	72,710
July	20,508	2,572	3,643	679	3,166	2,327	--	9,460	1,436	[illegible]5,120	[illegible]41,666	[illegible]73,154
August	20,462	2,709	3,746	679	2,843	2,135	--	9,390	1,228	[illegible]4,976	[illegible]41,003	[illegible]72,459
September	21,012	2,670	3,716	679	3,161	2,190	--	9,520	1,381	[illegible]4,899	[illegible]41,229	[illegible]73,318
October	21,158	2,592	3,722	609	2,996	2,273	--	9,600	1,507	[illegible]5,038	[illegible]41,614	[illegible]73,938
November	20,873	2,594	3,727	609	2,901	2,287	--	9,425	1,489	[illegible]5,006	[illegible]41,582	[illegible]73,751
December	21,474	2,515	3,607	609	2,954	2,235	--	9,400	1,436	[illegible]5,072	41,355	74,202
Average	20,682	2,611	3,729	637	3,082	2,270	--	9,437	1,477	[illegible]5,103	41,637	73,310

[a] Organization of the Petroleum Exporting Countries.
[b] The Persian Gulf Nations are Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates. Production from the Neutral Zone between Kuwait and Saudi Arabia is included in "Persian Gulf Nations."
R=Revised. NA=Not available. -- = Not applicable. E=Estimate.
Notes: • Crude oil includes lease condensate but excludes natural gas plant liquids. • Monthly data are often preliminary figures and may not average to the annual totals because of rounding or because updates to the preliminary monthly data are not available. • Data for countries may not sum to World totals due to independent rounding. • U.S. geographic coverage is the 50 States and the District of Columbia.
Web Page: See http://www.eia.doe.gov/emeu/mer/inter.html for all available data beginning in 1973.
Sources: See end of section.

Source: EIA Monthly Energy Report – March 2008

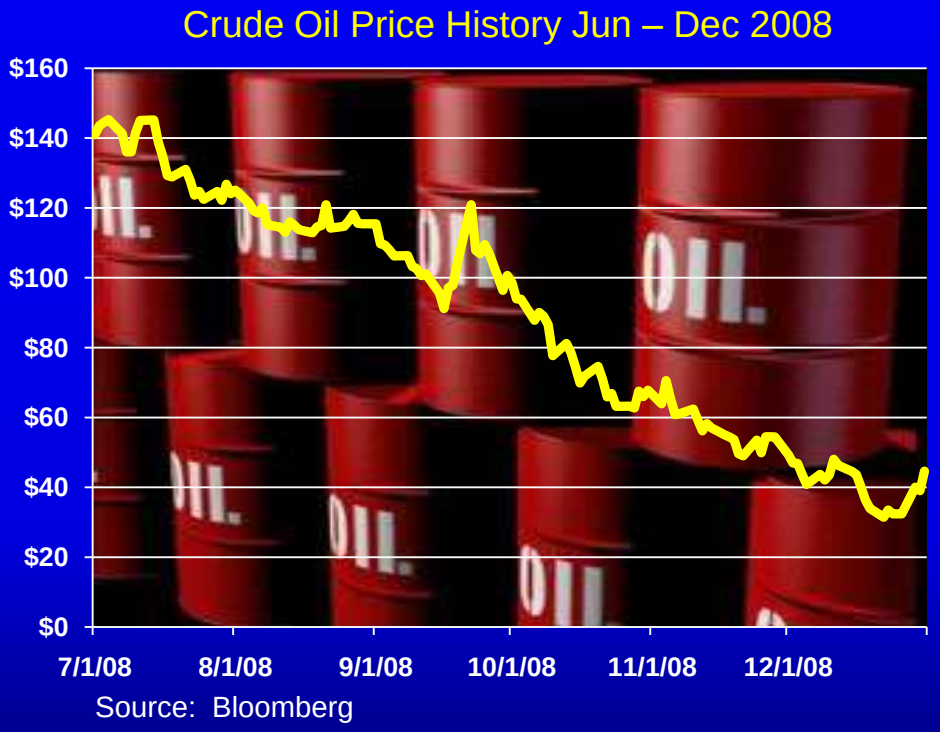
The Supply Picture Is Not Pretty (And Explains $147 Oil)



- There are no bright spots on supply horizon.
- There are many flashing red lights that “all is not well”:
  - Civil unrest in key oil producing regions
  - Fragile aging infrastructure
  - Accelerating decline rates due to oil field technology
- Visible oil stocks keep getting “too tight.”
- These all explain why oil prices rose 15 fold.

What Explains The Crude Oil Price Collapse?

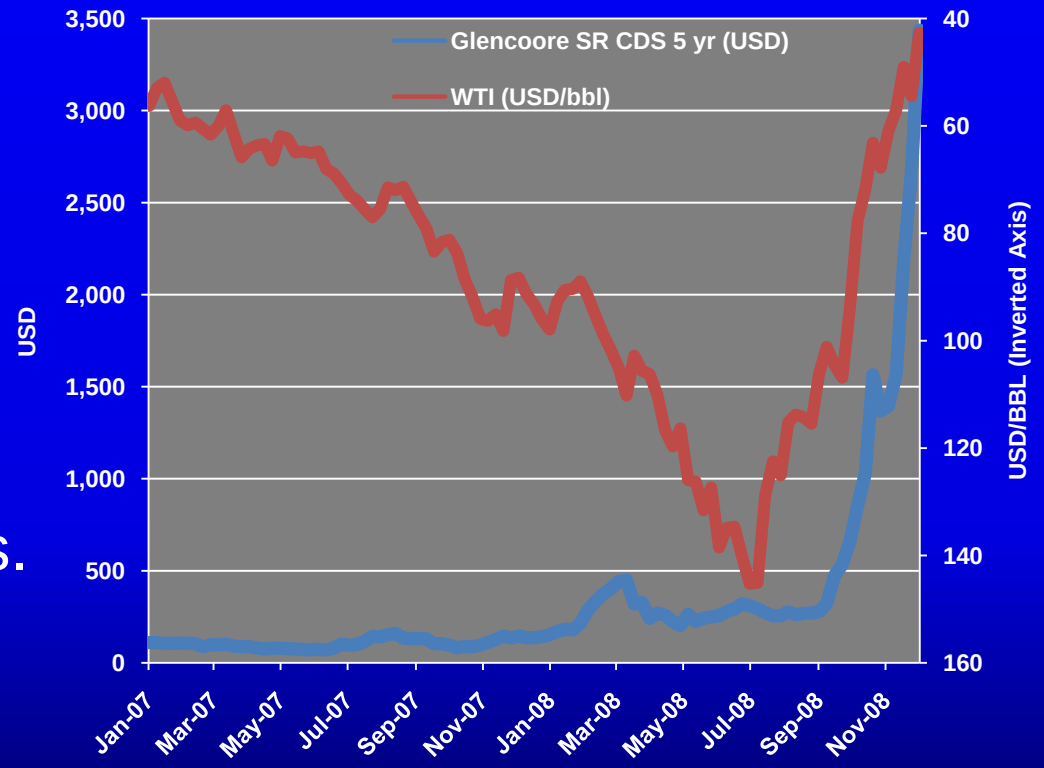
- Media and pundits say:
  - Speculators left the game that created spike
  - Unraveling economy killed off demand
  - Gluts are now endemic:
    - Tank farms brimming with oil
    - Super-tankers now floating oil gluts
- But, non of these "facts" can be proven.



- Only clear fact: "Crude oil fell 74% in 12 weeks" (September 22nd – December 22nd).

Are We Missing "The Black Swan?"

- Credit default swap index soared as crude oil plunged.
- Credit freeze began when oil collapsed.
- This had to hurt traders ability to own oil contracts.
- If any traders ever had to liquidate contracts, this would cause oil prices to temporarily fall.
- Glencore (aka Marc Rich & Co AG) Energy Trading Credit default swaps illustrate the squeeze.



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Are Current Oil Prices Now “Fair?”

- NO! They are dangerously low.
- Middle East producers now facing deficit spending.
- Key projects have been postponed or cancelled.
- Drilling rigs are being laid down.
- New rigs are facing credit problems with shipyards.
- Industry economics do not work at current prices.

What Do We Need Oil Prices Be?

- $100 - $147 oil did not increase crude supply.
- They did not alleviate rig and people shortages.
- They did not stimulate to rebuild an infrastructure now too old.
- They also did not cause catastrophic economic damage.
- They were starting to create booming prosperity across the oil world.

Is There An Oil Price That Begins To Cut This Gordian Knot?

- There is no hard data to shed light on this.
- $150 oil with a permanent floor might help for a while.
- But, this does not:
  - “Find more” oil
  - Quickly build more new drilling rigs
  - Recruit and train oil work force

When Do Oil Prices Get So High They Really Hurt Economies?

- Through 2007 - 1st half 2008, many key consuming regions paid retail prices for gasoline at $8 to $11 per gallon.
- This translates to $378 - $462/bbl for gasoline and no economic pain was evident.
- How the wellhead revenue for high oil prices gets reinvested is key to insure high prices help, not hurt, global economies.

High Prices Do Not Address Oil Industry's Twin Cancers

- Two "issues" threaten oil industry's sustainability.
- Both took decades to develop into twin cancers.
- Neither has any clear way to quickly resolve.
- Both could take decades to re-dress.

The "Issues"

- People Crisis
- Rust

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Unresolved People Crisis Will Cripple Global Industry

- High percentage of current employee base of global oil industry will retire in next 5 – 7 years.
- This crisis touches every aspect of the industry:
  - Rig hands
  - Geologists
  - Engineers of all disciplines
  - Welders
  - Manufacturing workers
  - Executives across the face of industry
- How quickly can industry recruit and train millions of employees?

“Rust” Is A More Serious Twin Disease

- “Rust” is code word for aging oil delivery system.
- It is all built of steel, which begins to rust on day one.
- “Rust never sleeps” is timeless maritime phrase.
- High percentage of “delivery system” from well bores, gathering system, tank farms, pipelines, tankers, refineries, rigs, other oil service assets and service stations tanks, etc., etc. beyond original design life.
- The era of band-aids is over.
- The era to rebuild the entire infrastructure has to begin ASAP.

Conquering Rust Will Be World's Largest And Most Complex "Project"

- Replacing even 80% of global delivery system of oil will be more costly and complex than fighting WWII or Marshall Plan.
- Total cost might exceed $100 trillion.
- Manpower needs could exceed 500,000 to 1 million engineers, construction workers, etc.

- Could the world run out iron ore and steel in getting the task done?

Oil Prices Need To “Snap Back” Fast

- The longer current prices stay low, the higher the odds rise the industry will destroy itself.
- Industry leaders/stakeholders need to re-examine how little is known about what sets oil prices, the aging of industry key assets and the reality that oil has peaked.
- Someone needs to abolish current extreme volatility before it destroys the industry.

Saipem is first to confirm Aramco's block on further work

Saudi contractors in grip of freeze

VAHE PETROSSIAN, London

Saudi Arabia's review of oil and gas projects is gaining momentum as several contractors confirm being told to freeze almost all work while state oil company Saudi Aramco completes a study on how to cut costs.

Contractors are asked to revise prices or put work on hold

Saudis start to push costs drive

VAHE PETROSSIAN, London

Contractors working in Saudi Arabia have started receiving notices from Saudi Aramco either putting work on hold or asking that they revise their prices to reflect falling costs.

Source: Upstream – November 28, 2008

2009 Will Be Year Of Extreme Challenge

- If industry leadership keeps heads buried in sand, they deserve the blame for anguish this is causing.
- New Obama Administration needs to get quickly educated on these key issues.
- Easiest way to crush any economic recovery is to end up with oil shortage and sky-rocketing oil prices.
- Natural gas might be worse shape than oil.
- 2009 needs to be “Year of Enlightenment.”

What To Watch For As 2009 Unfolds

- Watch how fast rigs working slow down.
- Watch oil stocks getting tight.
- Watch production starting to declines as drilling stops.
- Watch the Ukraine/Russia/EU natural gas crisis.

- Watch the horror of layoffs ending a nascent recruiting era.
- Watch for sharp rebound in oil and gas prices when supply drops outstrip demand.

Does The Oil Business Have To Be "Boom And Bust?"

- Is the industry fated to lurch between feast and famine?
- With cost of new oil and gas projects so high, can anyone survive this volatility?
- When reality sets in that oil supply really peaked, can this usher in a Brave New World in oil?
- Or, does this exacerbate vicious volatility?
- Is this oil industry still sustainable?

Not on its current course.

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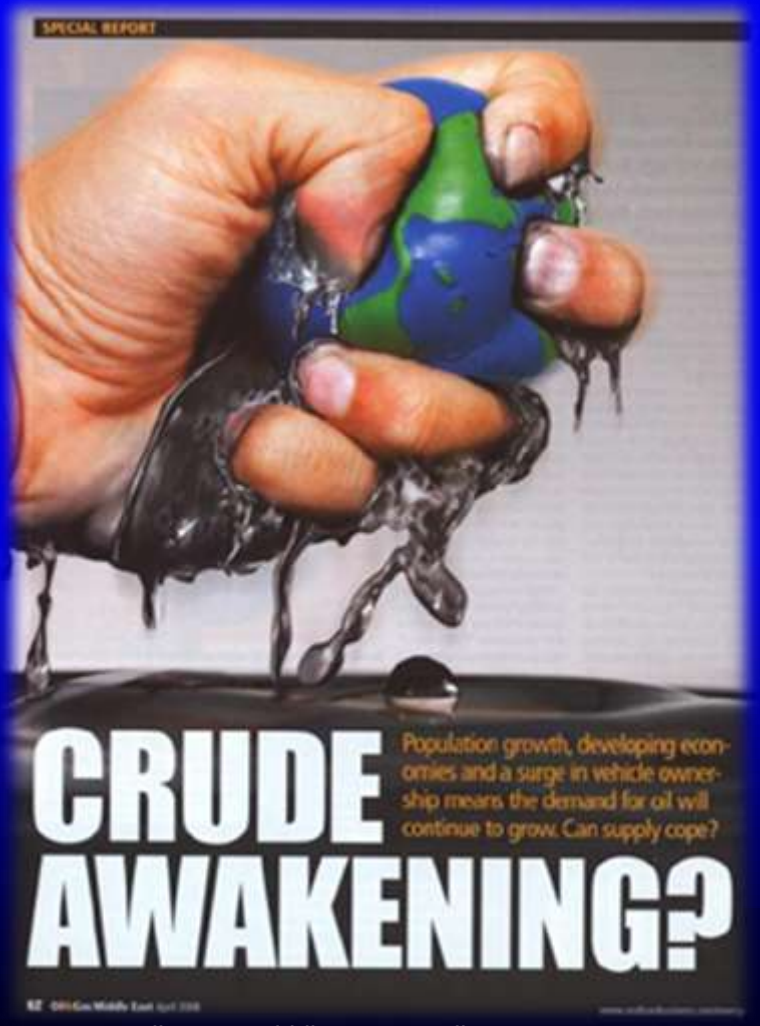
Can The World Adjust To Having Less Oil To Use?

- Not on present global blueprint.
- We are heavily embedded in an oil powered economy.
- Mobility, agriculture, distribution of food, etc., all depend on plentiful and reliable oil supplies.
- 90% of world population just starting down path America and Europe began after WWII.
- We have a brief window to change current path.
- Otherwise, future could be crazy.



Source: Oil & Gas Middle East , April 2008

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