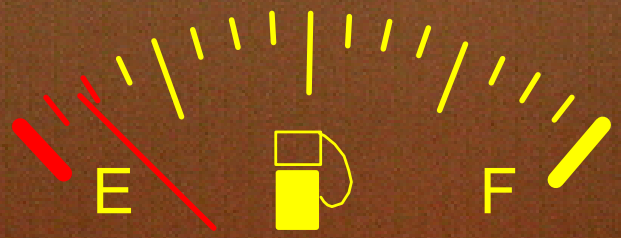
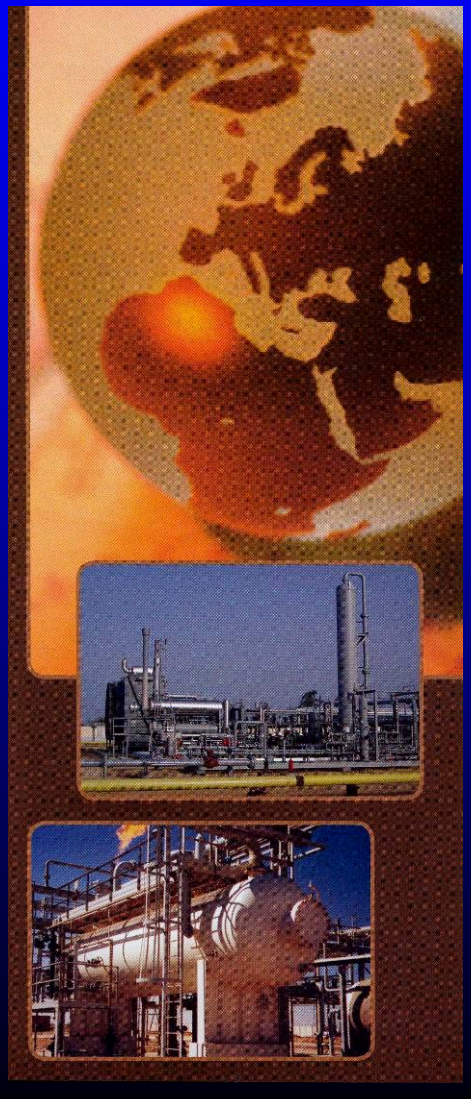
Is The Future Of Energy Sustainable?



The Charles and Thomas Lauritsen Memorial Lecture
California Institute of Technology
October 23, 2007
Pasadena, CA

By:
Matthew R. Simmons, Chairman
Simmons and Company International

Modern Energy Makes The World Work



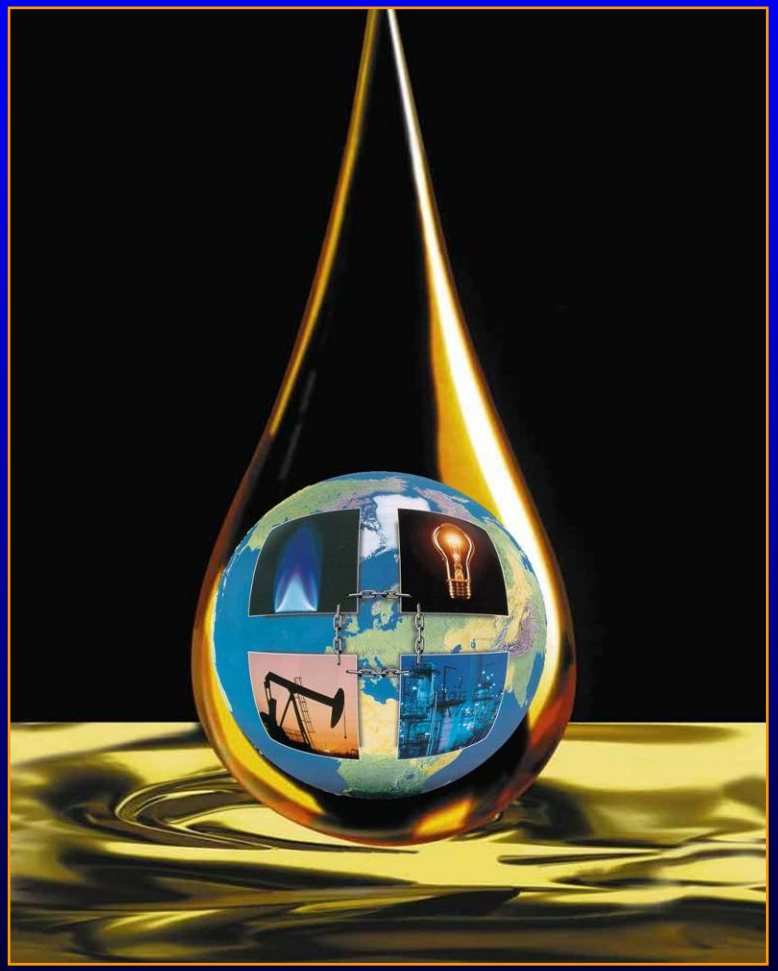
- Modern energy creates virtually all aspects of our society:
  - Technology
  - Healthcare
  - Mobility
  - Heating, cooling, lighting
  - 90% of food supply
  - Potable water
- It grew to be world's largest industrial activity.
- We still use 3 primary energy sources:

Oil	40%	Fossil Fuels
Coal	20%	
Natural Gas	20%	
Nuclear, Hydro, etc.	20%	

SIMMONS and COMPANY INTERNATIONAL

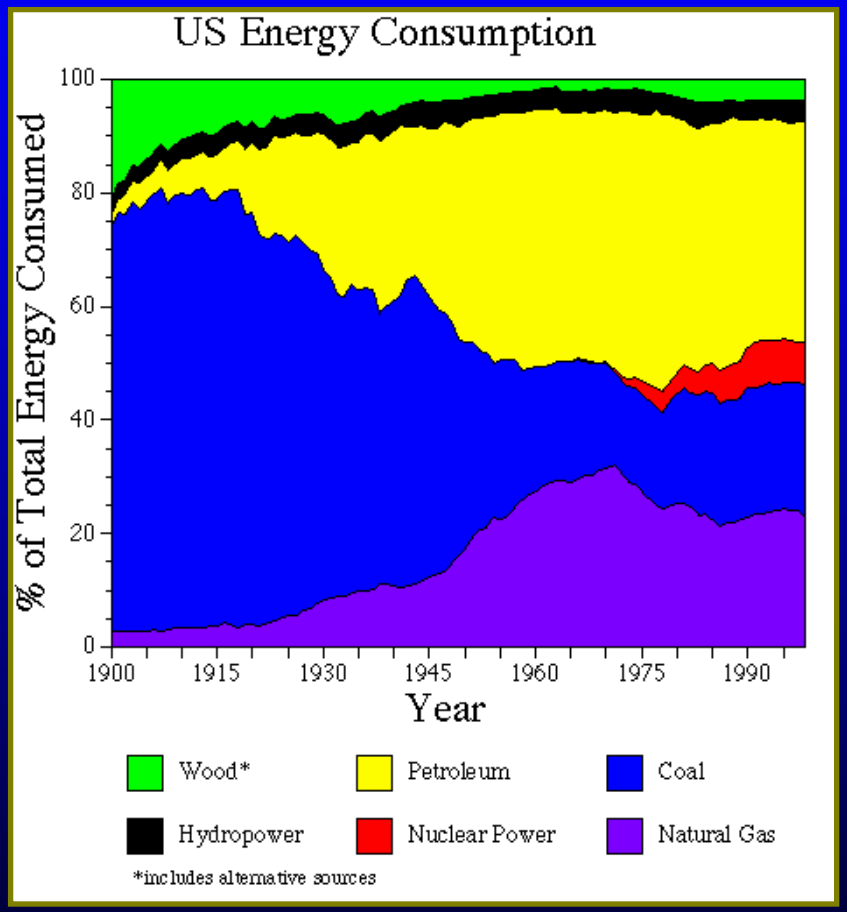
Fossil Fuel Energy Was 20th Century Miracle

- 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.



1900: A Very Dirty World

- 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.



SIMMONS and COMPANY
INTERNATIONAL

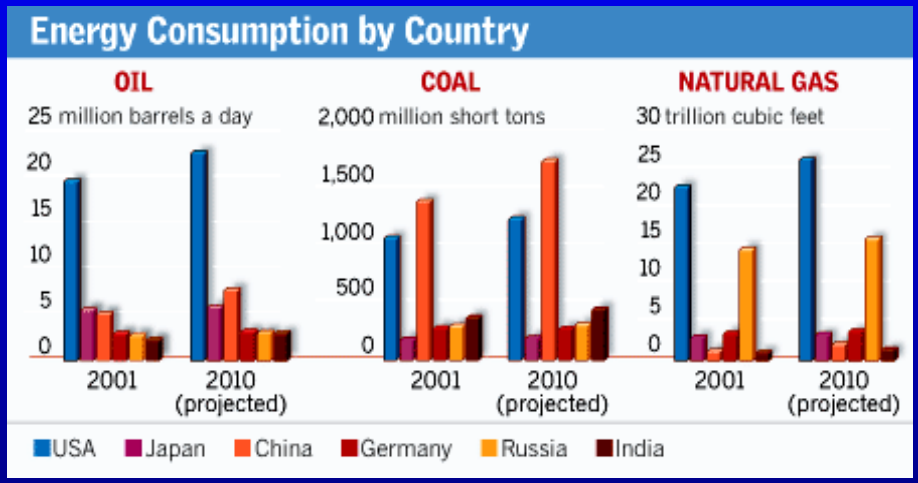
20th Century: The Hydrocarbon Era

- 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 Still Concentrated In Industrial Nations

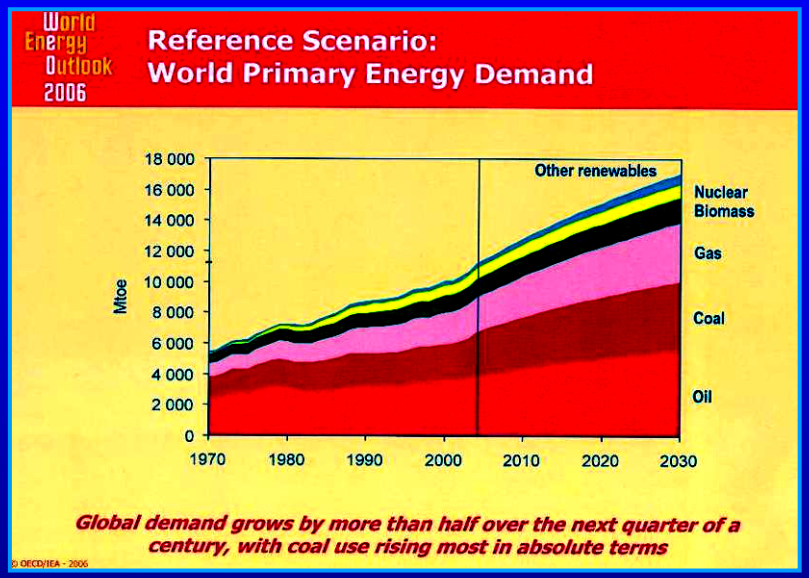
	% Use of World's Primary Energy
OECD Countries	49%
China	15%
Russia	6%
India	5%
Brazil	2%
Rest of the World	23%

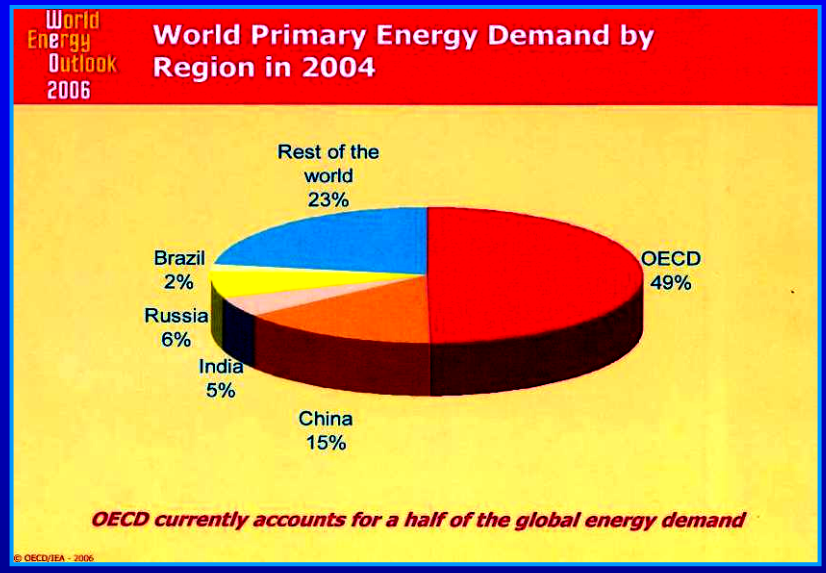


Disparity highlights world's vast rich/poor gap

SIMMONS and COMPANY
INTERNATIONAL

The World's Need For Energy Is Inexhaustible





- In 1980, global energy totaled 145 million BOE/day (1980 – 2004).
- 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

Oil Is Still The Energy King

- World is now using 88 million Bbls/day (1.35 trillion gallons/year).
- 1900 – 1990 oil demand grew to 66 million Bbls/day.
- In past 17 years, oil demand grew another 22 million Bbls/day.
- Increasing mobility drives this growth.
- World now has ≈900 million vehicles.
- We add 50 million vehicles to global fleet/year.

SIMMONS and COMPANY
INTERNATIONAL

Growth In Oil Use Seems Inexhaustible

- EIA, IEA, World Bank, et al. project steady growth through 2020 – 2030.
  - 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:

	Population	No. of Vehicles	Vehicles per 1,000 people
	---------- In Millions ----------		
North America	437	280	641
Western Europe	532	252	472
OECD Pacific	200	92	462
OECD Total	1,169	624	534
FSU/Eastern Europe	341	62	182
Developing Economies - China	1,314	23	18
Rest of the World	3,579	184	51

Source: OPEC's World Oil Outlook, 2007 (2004 Data)

Can Oil Supply Keep Pace With Rapid Growth In Demand?

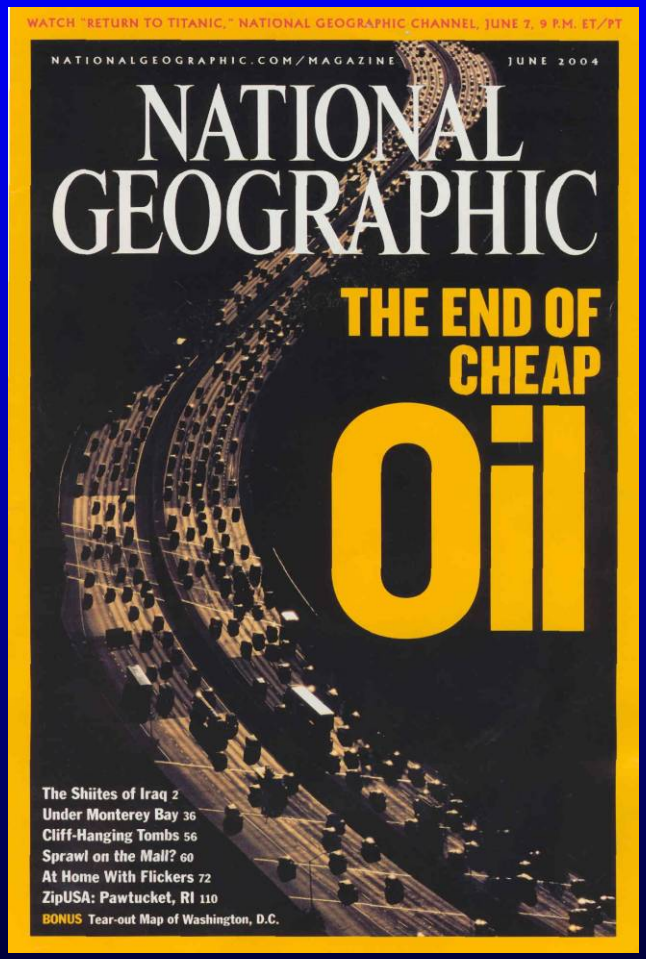
- For decades, world's energy planners assumed oil resources were limitless:
  - Middle East oil abundant. Is far more yet-to-be found?
  - Technology drove new discoveries in our oceans
  - Technology unlocking vast oil sands and some day, oil shale
- How the world prevents an oil glut.
- Keeping peace in the Middle East.

Our twin energy worries

- Most economists (post-1982) assumed oil prices would stay low.

Oil "Pessimists" Were Largely Ignored

- The pioneers who predicted the end to cheap oil were largely discredited.
- The litany of warnings were ignored:
  - Last new frontier discovered four decades ago
  - Last new giant oilfield discovered in 1976
  - Peaking of USA's oil (1970) not fully appreciated
  - Steadily dwindling and smaller oil field discoveries
  - World using far more than we found
- Massive reported "Proven Reserves" created false sense of security.



SIMMONS and COMPANY
INTERNATIONAL

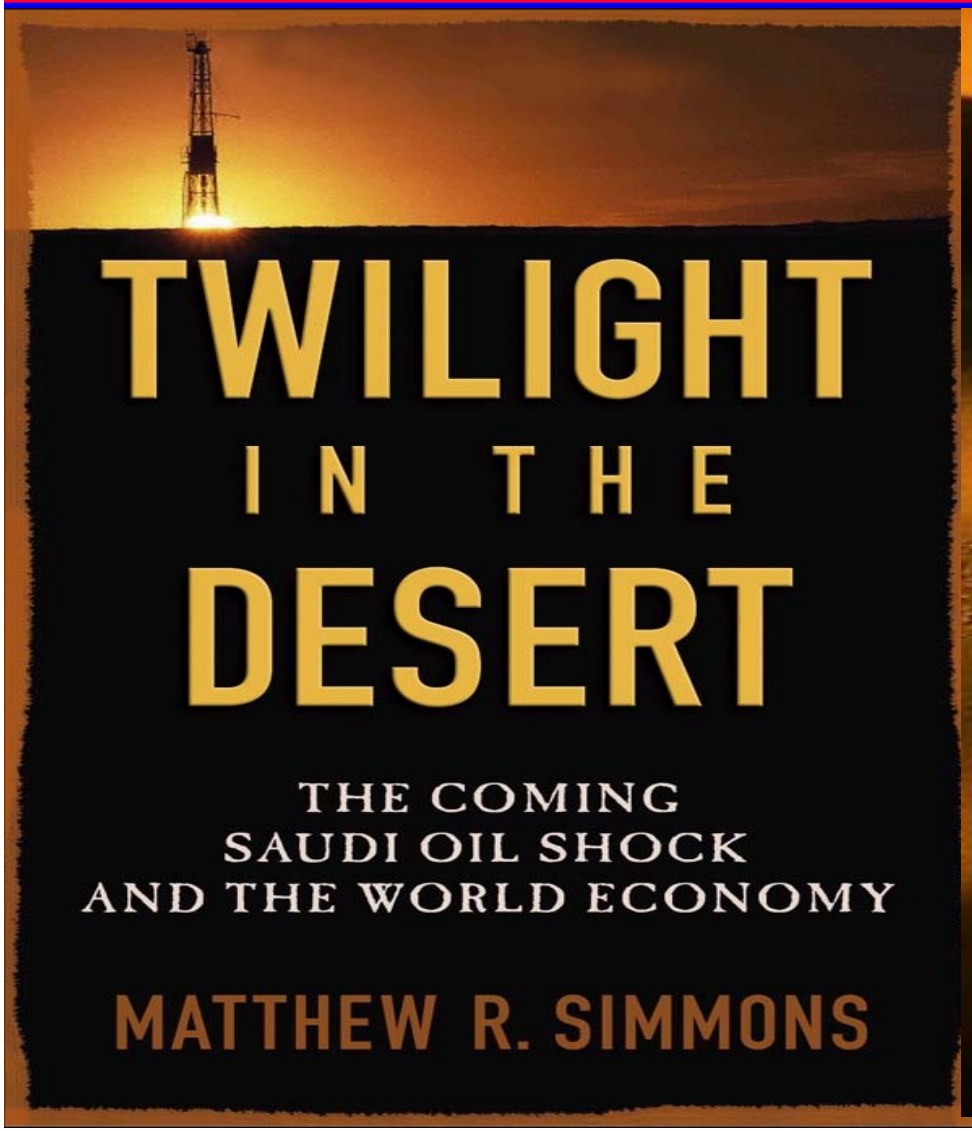
Oil Field Technology Revolutionized How We Explore And Produce Oil And Gas

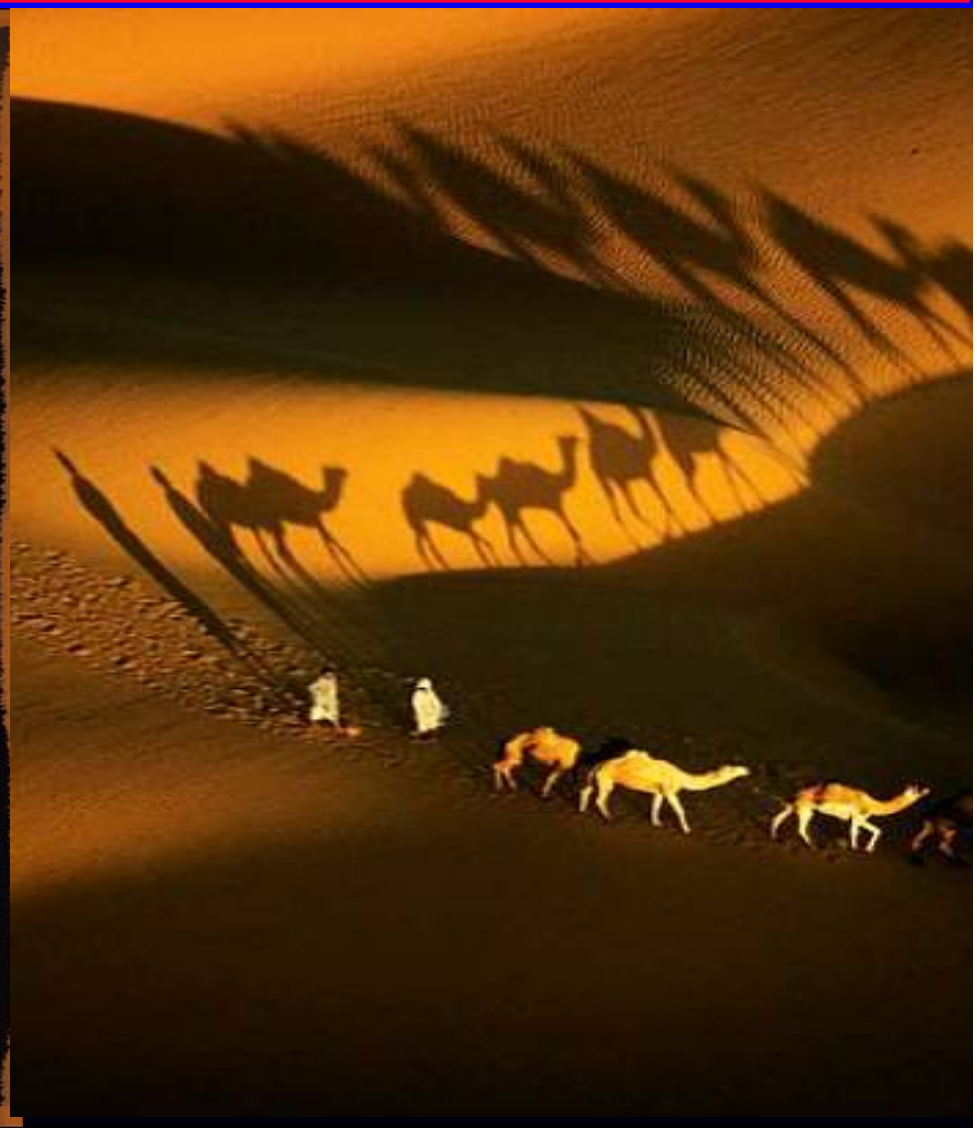
- 1970 – 1990 ushered in remarkable wave of technical innovations:
  - Deepwater oil and gas
  - Subsea satellite systems
  - Horizontal and steerable drilling
  - Multilateral well completions
  - 3 and 4 dimension seismic

From invention to commercialization took two decades

- 1996 – 2007: New technology applications spread around the world.
- But, few appreciated these gains were creating just-in-time supply:
  - Decline rates soared
  - Reserve extensions merely extended tail end of production

Opening The Curtain On Middle East Oil





Understanding Middle East Oil

- My continuous oil and gas research led me to grasp:
  - Middle East had only 35 – 40 giant oil fields
  - All were now getting very mature
  - Three decades of exploration found no large fields
- Two years of research of technical papers led me to write:

Twilight In the Desert:
The Coming Saudi Oil Shock And The World Economy

- At outset of this project, my skeptics were numerous.
- Two years after book was published, skeptics shrank considerably.

Twilight In The Desert (For Oil) Is A Reality

- Now, many other analysts have done same homework.
- Saudi Arabia faces massive challenge to keep current production flat (or implement small growth).
- Old belief that Saudi Arabia could produce 12 – 25 MM Bbl/day was an illusion.
- How fast their great giant oil fields decline is a serious question.
- Lack of production transparency is appalling.

'The West is deluded to rely on Saudi oil'

Matthew Simmons doesn't look like a contrarian. He comes across as what he is: an oil-industry magnate. Over the past 30 years, the Texas-based investment bank he founded – Simmons & Co International – has guided countless blue-chip clients through oil deals worth $60bn (£33bn), *writes Liam Halligan.*

Despite these credentials, Simmons holds controversial views that pit him against almost the entire Western oil establishment. In his London offices last week, he told me he is "deeply concerned" that Saudi Arabia's oil will run out.

"For decades, Saudi has been the most important producer on earth," he says. "They have been the only country able to pump extra crude when the West needs it, and everyone just assumes that spare capacity will last."

With oil prices above $50 a barrel, having risen by 80 per cent this year, the West is indeed relying on yet more Saudi crude. "This is delusion," says Simmons. "Saudi oil output may soon start declining – imminently, in my view, in the next six to 36 months."

Simmons' warning is based on "a very close study of hundreds of technical reports" produced by the Desert Kingdom's own engineers. Saudi's oil capacity is "dangerously concentrated," he says. "Six fields have yielded 95 per cent of all Saudi oil ever produced, with a single field – Ghawar – pumping 60 per cent. But the Saudis have pushed these fields hard. And when you push big fields, reservoir pressures fall."

His analysis, if correct, is scary. It would exert severe upward pressure on already sky-high oil prices – with devastating implications for financial markets and economic growth worldwide.

"But the conventional wisdom," Simmons says, "that we can rely on Saudi oil indefinitely is driven only by 'groupthink' and vested interests."

The Energy Information Administration, part of the US government, forecasts global oil demand of 120m barrels daily by 2025 – up 50 per cent on the current consumption of 80m. Over the same period, the EIA says, Saudi production will rise from 9m bpd to 22m. Put simply, in 20 years' time the world will rely on Saudi for 19 per cent of all oil production – a dramatic increase on the country's current 11 per cent share.

Having served on vice president Dick Cheney's energy task force, Simmons knows these forecasts well. "The EIA numbers are the global economy's energy roadmap," he says. "But while their demand estimates are real, they basically invent the future production numbers as they go along."

So what of US government claims that Saudi will pump 22m bpd in 2025? "If, by some miracle, they find some huge fields that have defied discovery for 50 years," Simmons says, "it might happen. Then again, I could be living on the moon in 2025.

"I would say the probability of me living on the moon is higher than Saudi reaching 22m barrels."

Officially, the Saudis dismiss Simmons' analysis. "Matt is talking rubbish," oil minister Ali Al-Naimi has said. So when I went from Simmons' office to meet Sadad Al-Husseini, I expected him to trot out the same line.

CHARLES COATES

Al-Husseini: forecast concerns

After all, until March, Al-Husseini was head of exploration and production at Aramco, the state-owned oil monolith which accounts for 97 per cent of Saudi's crude output. Yet, astonishingly, Al-Husseini lent some credence to Simmons' views.

"The question isn't 'can we can pump 15m or 20m barrels daily?'," he says. "The question is, how long it can be sustained? We could only manage 22m bpd for a very short time – maybe 10 years. And that would mean an awful lot of depletion, which isn't in the best interests of the global economy."

What does Al-Husseini make of US estimates of future Saudi production? "These are US numbers, not ours," he says. "The American production outlook is much too high."

When I ask Al-Husseini where the EIA is going wrong, he echoes Simmons: "The EIA focuses only on demand. That is why they overestimate not only future Middle East supplies but non-Opec and Russian supplies too."

We agree the production outlook for the Middle East as a whole – which the EIA predicts will almost double, from 21m bpd today to 40m in 2025 – depends crucially on Iraq.

"The country does have substantial reserves," says Al-Husseini. "But after years of neglect, it will take a long time for Iraq's oil infrastructure to make a significant contribution to global supplies." How long? "I doubt they can exceed 3m barrels a day by the end of this decade."

Al-Husseini refutes Simmons' claims that the Saudis have partly squandered capacity by pumping too quickly in the past. "The Kingdom's oil is managed in a highly professional manner," he says. "But Simmons' concerns over US output forecasts are legitimate concerns."

Where do these two very different oilmen think prices are going next? Simmons thinks prices are unlikely to ease. "This winter, global demand will considerably exceed supply," he says. "So it is inconceivable prices could fall by much."

Again, Al-Husseini's view is similar. "I suspect prices around $50 will be with us for a while," he says. And then he issues his own Saudi-related warning. "The excess capacity is no longer there. That will mean more of the volatility and price surges. And the financial markets have yet to wake up to that."

● *Liam Halligan is Economics Correspondent at Channel 4 News*

Source: The Sunday Telegraph ,"The West Is Deluded To Rely On Saudi Oil", October 31, 2004

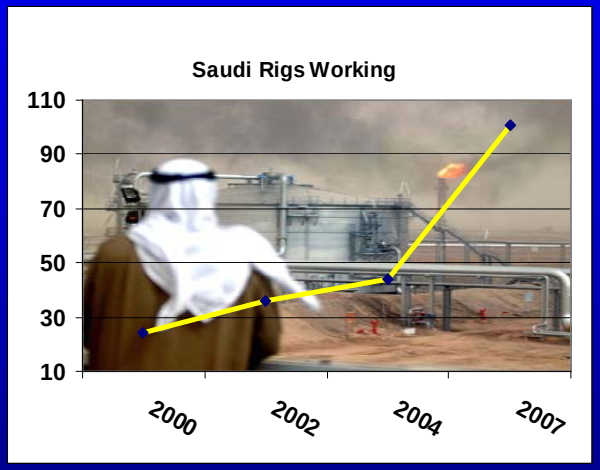
My Conclusion When *Twilight* Was Written

- Conclusion #1:
  - Saudi Arabia will struggle to attain small production growth.
- Conclusion #2:
  - There is a real risk that Saudi Arabian oil could soon start to decline.
- Conclusion #3:
  - When it is clear that Saudi Arabia's oil has peaked, the world's supply too has peaked.

Two Years Later, What Do We Know?

- Saudi Arabia is struggling to recreate supply cushion:

Year	Rigs Working
2000	24
2002	36
2004	44
2007	101



- E&P spending $70 billion to rehabilitate several old fields.
- Expected output from 2/3rd of these "new" projects to offset declines in Saudi Arabia's "mature fields".
- Saudi Arabia's oil exports to IEA member countries peaked in 2003 and have steadily shrunk.

Ghawar – Running Dry?

THE WORLD IN NUMBERS

The world's most essential oil field may be in decline.

Running Dry?

BY JAMES D. HAMILTON

No country is more important to oil markets than Saudi Arabia. The kingdom produced roughly 9.2 million barrels of crude a day in 2006, and accounted for 19 percent of world oil exports. Many analysts expect it to supply a quarter of the world's added production over the next few years. And as the only producer with significant excess capacity, it has played a crucial role in alleviating temporary supply disruptions, increasing daily production by 3.1 million barrels during the first Gulf War, for example, when oil production in Iraq and Kuwait dropped by 5.3 million barrels.

The Ghawar oil field is the kingdom's crown jewel. Stretching for more than 150 miles beneath the desert, it is the largest known deposit in the world. It produces perhaps twice as much oil as any other field, and has doubtless accounted for more than half of Saudi Arabia's oil production. Yet the Saudis have been removing oil from this reservoir for half a century. Sooner or later, its production must fall.

The Saudis do not release data on how much oil they are extracting from individual wells, or on the remaining reserves of individual oil fields. But the total amount that the kingdom produces has been declining, down a million barrels a day over the last two years of data.

The Saudis have claimed these cuts have been in response to weak demand. However, the big drop in production began in the spring of 2006, when the price of oil was rising from $60 to $74 a barrel; the claim that no one wanted to buy Saudi Arabia's light crude strains credulity. The drop in production has also coincided with a huge new Saudi effort to find and pump more oil: The number of active oil rigs in Saudi Arabia has tripled over the past three years.

Frustrated by the lack of hard data on Ghawar, Stuart Staniford, a computer scientist with a doctorate in physics, has conducted a painstaking study of publicly available information. His research has been reported at theoildrum.com, a Web site that analyzes energy markets.

The Saudis have developed Ghawar by using peripheral water injection—water is pumped into the reservoir, driving the remaining oil to the surface. More details about Saudi production were available before 1980, allowing Staniford to infer that the depth of the remaining oil column in northern Ghawar at that time was about 500 feet. Evidence from many sources suggests that the water level has been rising at about 18.4 feet per year. If you extrapolate that trend, this would mean that the northern part of Ghawar is by now quite depleted.

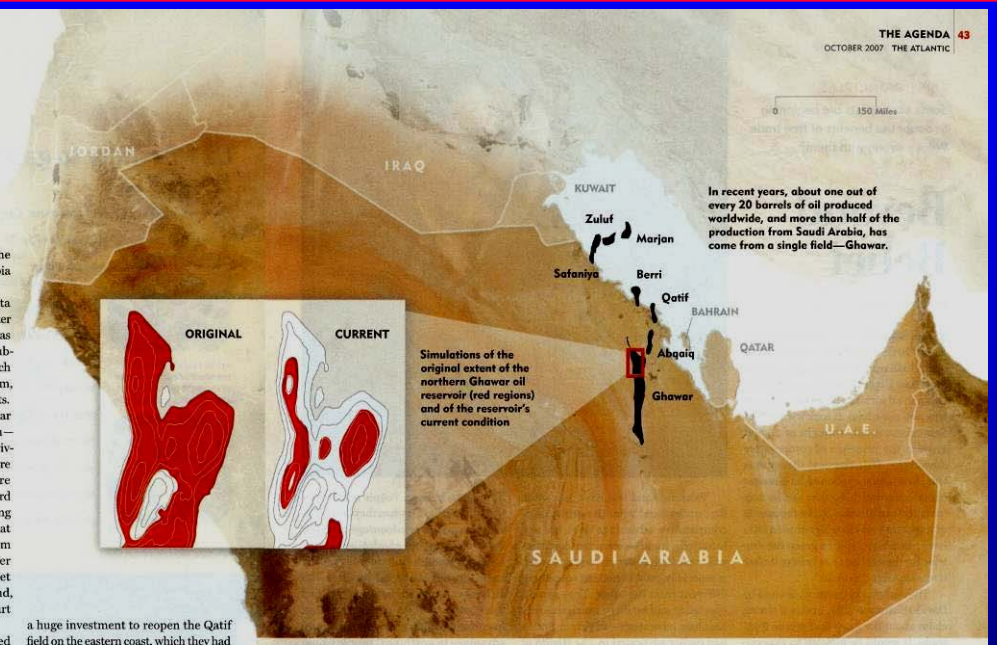
Staniford has also built a detailed computer simulation of the Ghawar reservoir, based on its size and shape, the porosity and permeability of its rock, and the assumed oil-extraction rates. The results of this simulation line up remarkably well with Staniford's other calculations. Oil production from northern Ghawar has likely peaked.

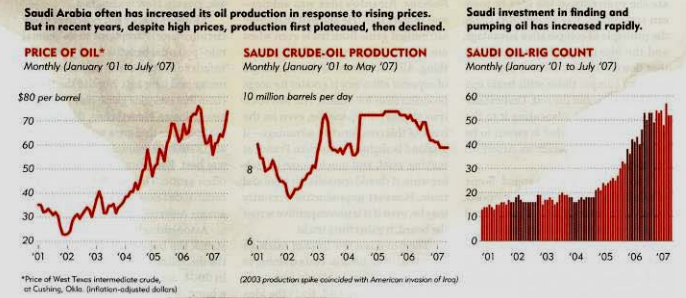
Southern Ghawar still holds a lot of oil, and perhaps the kingdom's push to find new fields will bear fruit. But northern Ghawar was developed first because it was by far the most promising field. Its production cannot be easily replaced. At about the same time that Saudi production began its decline, the new Haradh project in southern Ghawar began producing perhaps an additional 300,000 barrels a day. The Saudis have also made a huge investment to reopen the Qatif field on the eastern coast, which they had abandoned in 1995; it is now producing an estimated half-million barrels a day. With Saudi production falling despite these new contributions, the situation could be serious.

At a bare minimum, the era when excess Saudi capacity could cushion geopolitical disruptions in oil supplies may well be over, even though the threat of such disruptions is greater than ever. And if Saudi production continues to decline even as world demand keeps growing, in a few years we will look back at the summer of 2007 as the last of the days when gasoline—even at $3.50 a gallon—was still plentiful and cheap.

James D. Hamilton is a professor of economics at the University of California, San Diego; his analysis appears regularly at www.econbrowser.com.

SOURCES: ENERGY INFORMATION ADMINISTRATION; BAKER HUGHES
GRAPHICS BY RYAN MORRIS; SIMULATION ACHIEVED NOW ANALYSIS BY STUART STANIFORD





Source: The Atlantic, October 2007

What More We Know Now…

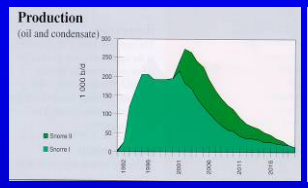
- Cantarell, Mexico's super-giant oil field (2nd in the world), peaked in May 2005 and is now in steady decline.
- China's three giant oil fields are also now in decline.
- North Sea production in free-fall decline.
- Indonesia is now an oil importer.

There has not been a single significant positive supply event to improve our long-term supply outlook.

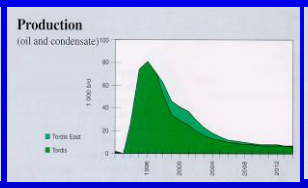
North Sea Decline Curves

(From Saga Petroleum Report)

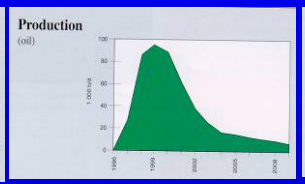
Snorre B



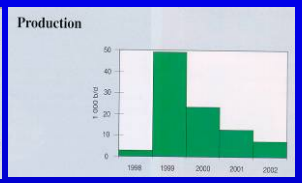
Tordis East



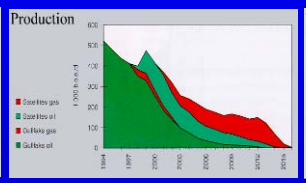
Vigdis



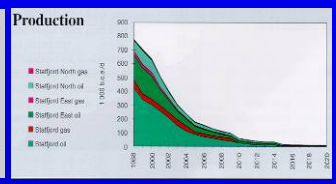
Varg



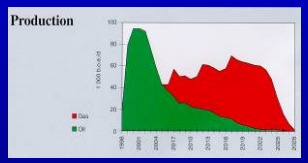
Gullfaks Satellites



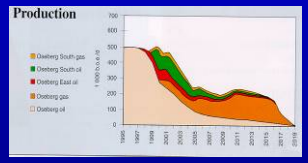
Statfjord Field



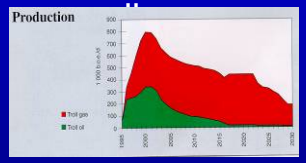
Visund



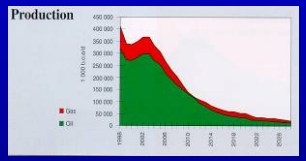
Oseberg Area



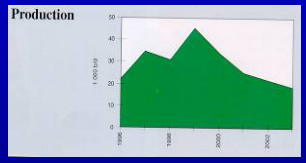
Tro



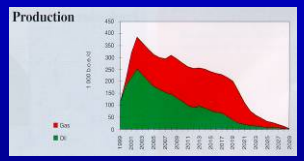
Ekofisk Area



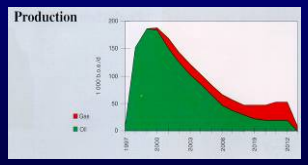
Gullfaks Satellites



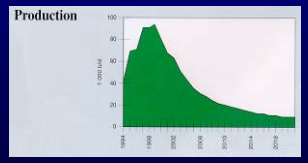
Asgard



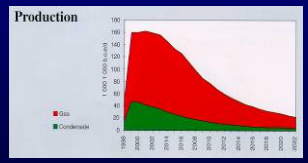
Norne



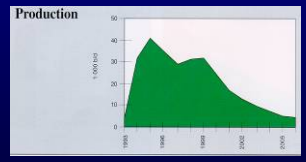
Alba



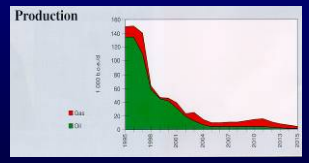
Britannia



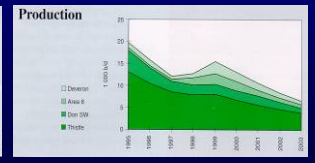
Gryphon



Miller

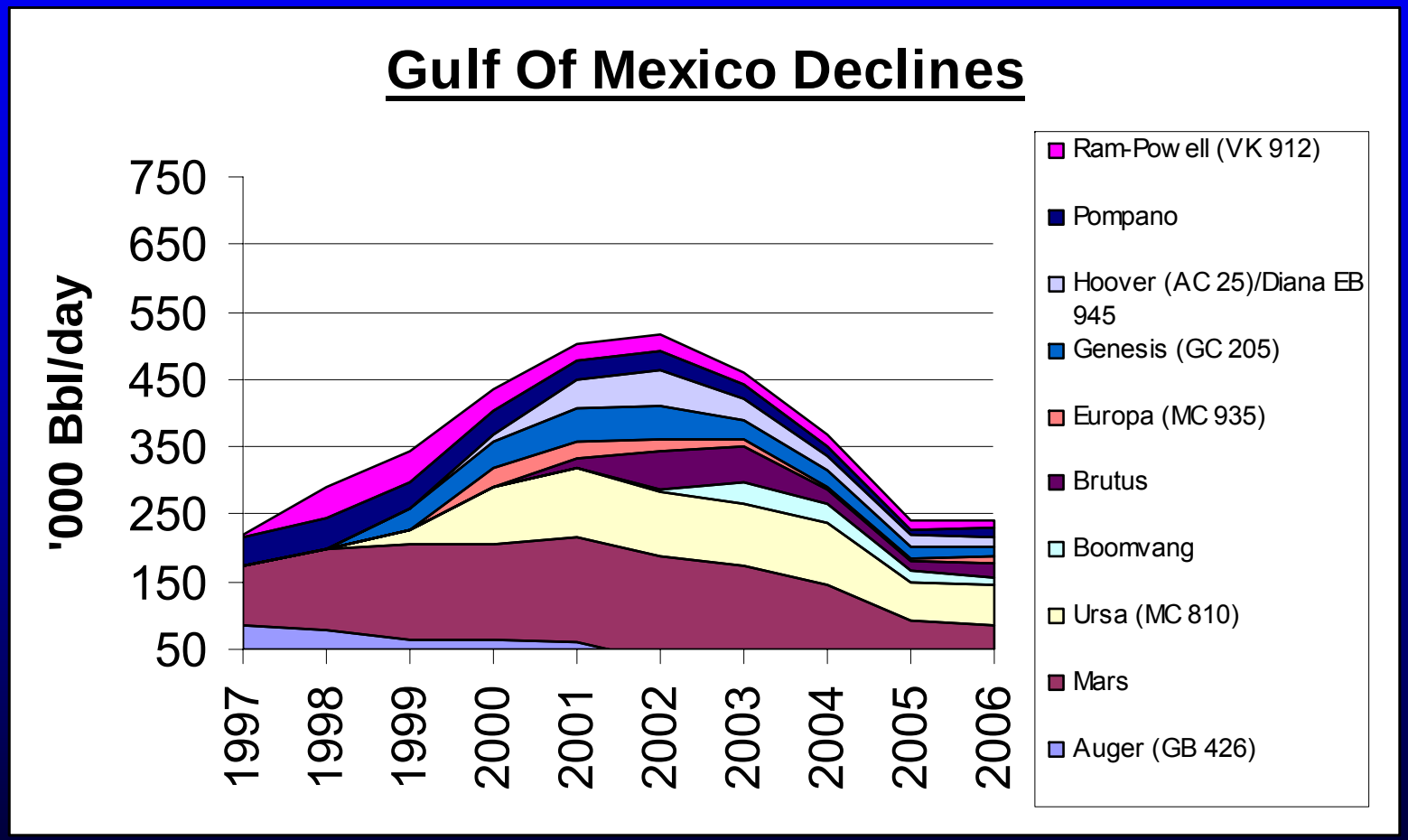


Thistle
With Satellites



SIMMONS and COMPANY
INTERNATIONAL

Gulf Of Mexico Deepwater Fields Also Declining



SIMMONS and COMPANY
INTERNATIONAL

Best-In-Class Supply Data Is Alarming*

- All-time crude output set in May 2005.
- Over next 18 months, supply has declined ≈1.5 MMB/day.
- Light sweet crude clearly in decline.
- Much is offset by rise of heavy and sour oil supply which is much harder to process.

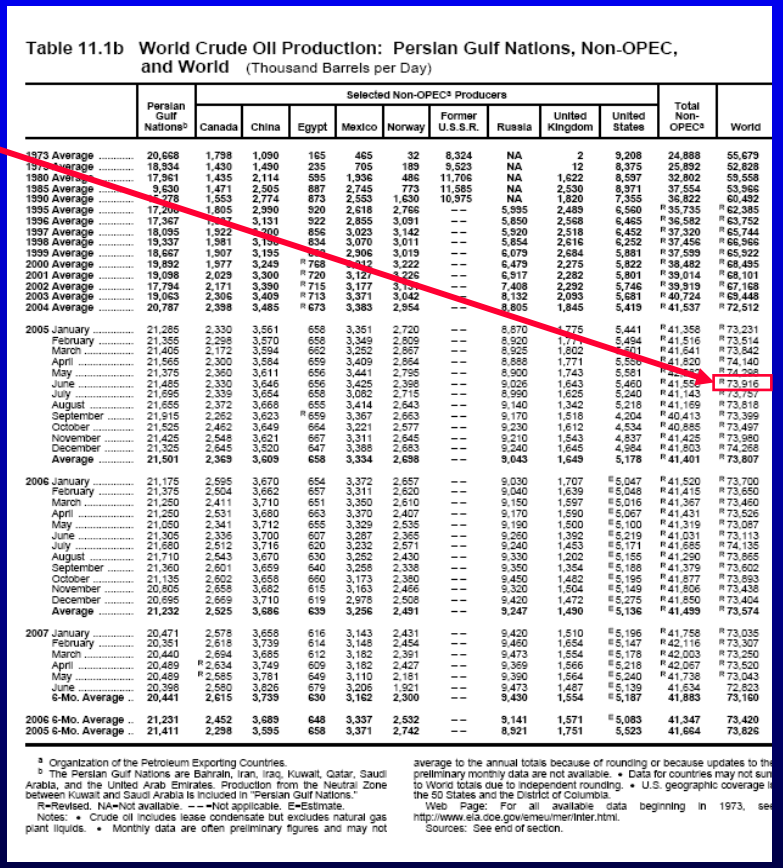


Table 11.1b World Crude Oil Production: Persian Gulf Nations, Non-OPEC, and World (Thousand Barrels per Day)

	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	55,679
1979 Average	18,934	1,430	1,490	235	705	189	9,523	NA	12	8,375	25,892	52,828
1980 Average	17,961	1,435	2,114	595	1,936	486	11,706	NA	1,622	8,597	32,802	59,558
1985 Average	9,630	1,471	2,505	887	2,745	773	11,585	NA	2,530	8,971	37,554	53,966
1990 Average	5,978	1,553	2,774	873	2,553	1,630	10,975	NA	1,820	7,355	36,822	60,492
1995 Average	17,206	1,805	2,990	920	2,618	2,766	--	5,595	2,489	6,560	R 35,735	R 62,385
1996 Average	17,367	1,827	3,131	922	2,855	3,091	--	5,850	2,568	6,465	R 36,582	R 63,752
1997 Average	18,095	1,922	3,200	856	3,023	3,142	--	5,920	2,518	6,452	R 37,320	R 65,744
1998 Average	19,337	1,981	3,156	834	3,070	3,011	--	5,854	2,616	6,252	R 37,456	R 66,966
1999 Average	18,667	1,907	3,195	798	2,906	3,019	--	6,079	2,684	5,881	R 37,599	R 65,522
2000 Average	19,892	1,977	3,249	R 768	3,012	3,222	--	6,479	2,275	5,822	R 38,482	R 68,495
2001 Average	19,098	2,029	3,300	R 720	3,127	3,226	--	6,917	2,282	5,801	R 39,014	R 68,101
2002 Average	17,794	2,171	3,390	R 715	3,177	3,139	--	7,408	2,292	5,746	R 39,919	R 67,168
2003 Average	19,063	2,306	3,409	R 713	3,371	3,042	--	8,132	2,093	5,681	R 40,724	R 69,448
2004 Average	20,787	2,398	3,485	R 673	3,383	2,954	--	8,805	1,845	5,419	R 41,537	R 72,512
2005 January	21,285	2,330	3,561	658	3,351	2,720	--	8,870	1,775	5,441	R 41,356	R 73,231
February	21,355	2,298	3,570	658	3,349	2,609	--	8,920	1,774	5,494	R 41,516	R 73,514
March	21,405	2,172	3,594	662	3,252	2,667	--	8,925	1,802	5,501	R 41,641	R 73,842
April	21,565	2,300	3,584	659	3,409	2,864	--	8,888	1,771	5,550	R 41,820	R 74,140
May	21,375	2,360	3,611	656	3,441	2,795	--	8,900	1,743	5,581	R 41,787	R 74,288
June	21,485	2,330	3,646	656	3,425	2,398	--	9,026	1,643	5,460	R 41,559	R 73,916
July	21,655	2,339	3,654	658	3,082	2,715	--	8,990	1,626	5,240	R 41,143	73,757
August	21,655	2,372	3,668	655	3,414	2,643	--	9,140	1,342	5,218	R 41,169	R 73,818
September	21,915	2,262	3,623	R 659	3,367	2,663	--	9,170	1,518	4,204	R 40,413	R 73,399
October	21,525	2,462	3,649	664	3,221	2,577	--	9,230	1,612	4,534	R 40,885	R 73,497
November	21,425	2,548	3,621	667	3,311	2,645	--	9,210	1,543	4,837	R 41,425	R 73,980
December	21,325	2,645	3,520	647	3,388	2,683	--	9,240	1,645	4,984	R 41,603	R 74,268
Average	21,501	2,369	3,609	658	3,334	2,698	--	9,043	1,649	5,178	R 41,401	R 73,807
2006 January	21,175	2,595	3,670	654	3,372	2,657	--	9,030	1,707	E 5,047	R 41,520	R 73,700
February	21,375	2,504	3,663	657	3,311	2,620	--	9,040	1,639	E 5,048	R 41,415	R 73,650
March	21,250	2,411	3,710	651	3,350	2,610	--	9,150	1,597	E 5,016	R 41,367	R 73,460
April	21,250	2,531	3,680	663	3,370	2,407	--	9,170	1,590	E 5,067	R 41,431	R 73,526
May	21,050	2,341	3,712	655	3,329	2,535	--	9,190	1,500	E 5,100	R 41,319	R 73,087
June	21,305	2,336	3,700	607	3,287	2,365	--	9,260	1,392	E 5,219	R 41,031	R 73,113
July	21,660	2,512	3,716	620	3,232	2,571	--	9,240	1,453	E 5,171	R 41,585	R 74,135
August	21,710	2,543	3,670	630	3,252	2,430	--	9,330	1,202	E 5,155	R 41,290	R 73,865
September	21,360	2,601	3,659	640	3,258	2,338	--	9,350	1,354	E 5,188	R 41,379	R 73,602
October	21,135	2,602	3,658	660	3,173	2,380	--	9,450	1,482	E 5,195	R 41,877	R 73,893
November	20,805	2,658	3,682	615	3,163	2,466	--	9,320	1,504	E 5,149	R 41,806	R 73,438
December	20,695	2,669	3,710	619	2,978	2,508	--	9,420	1,472	E 5,275	R 41,850	R 73,404
Average	21,232	2,525	3,686	639	3,256	2,491	--	9,247	1,490	E 5,136	R 41,499	R 73,574
2007 January	20,471	2,578	3,658	616	3,143	2,431	--	9,420	1,510	E 5,196	R 41,758	R 73,035
February	20,351	2,618	3,739	614	3,148	2,454	--	9,460	1,654	E 5,147	R 42,116	R 73,307
March	20,440	2,694	3,685	612	3,182	2,391	--	9,473	1,554	E 5,178	R 42,003	R 73,250
April	20,489	R 2,634	3,749	609	3,182	2,427	--	9,369	1,566	E 5,218	R 42,067	R 73,520
May	20,489	R 2,585	3,781	649	3,110	2,181	--	9,390	1,564	E 5,240	R 41,738	R 73,043
June	20,398	2,580	3,826	679	3,206	1,921	--	9,473	1,487	E 5,139	41,534	72,823
6-Mo. Average	20,441	2,615	3,739	630	3,162	2,300	--	9,430	1,554	E 5,187	41,883	73,160
2006 6-Mo. Average	21,231	2,452	3,689	648	3,337	2,532	--	9,141	1,571	E 5,083	41,347	73,420
2005 6-Mo. Average	21,411	2,298	3,595	658	3,371	2,742	--	8,921	1,751	5,523	41,664	73,826

[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: For all available data beginning in 1973, see http://www.eia.doe.gov/emeu/mer/inter.html.
Sources: See end of section.

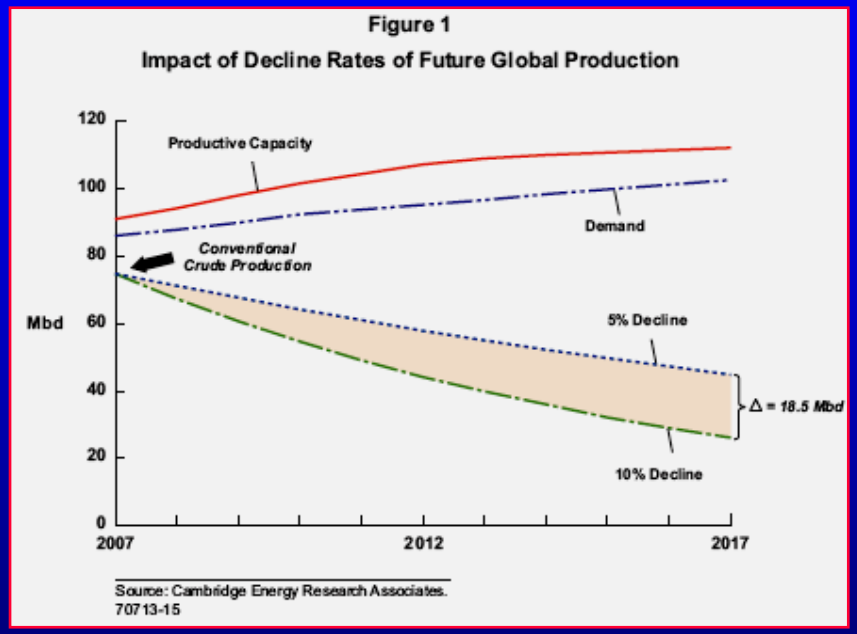
* EIA Monthly Energy Report. September 2007

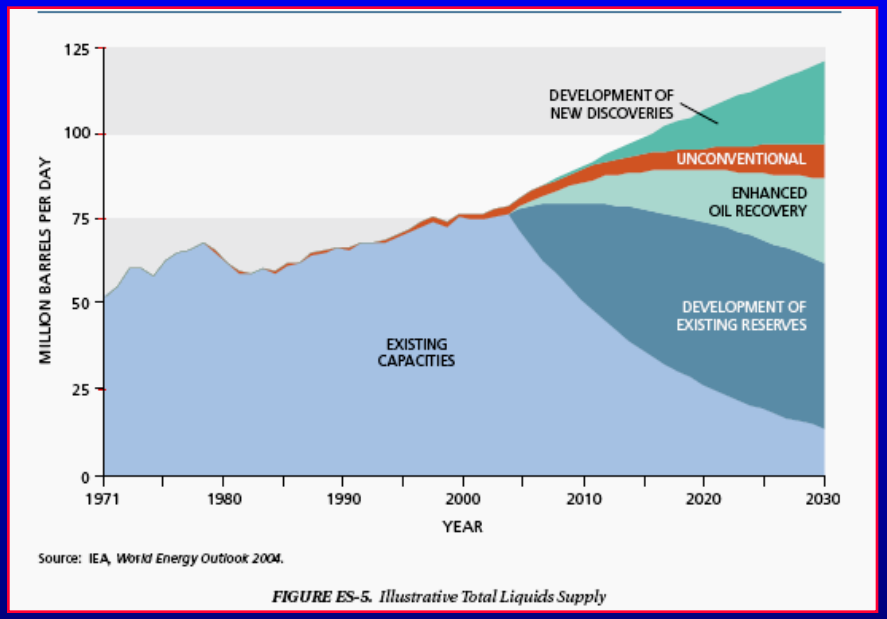
SIMMONS and COMPANY INTERNATIONAL

Decline Rates Are Now Severe Treadmill

- Scarcity of solid data on most oil fields masks a serious challenge to more growth in oil production.
- The North Sea fields are declining at a rate of 15 – 20% per annum.
- The deepwater fields (which peak faster) are declining at similar rates.
- Optimists on oil supply assume decline rates average 4.5% to 7% per year.

The Decline Rate Nightmare





- CERA's modest 5% decline still requires adding 60 MMB/D in 10 years.
- NPC estimates require adding over 100 MMB/D in 23 years.

SIMMONS and COMPANY
INTERNATIONAL

Crude Supply Not Getting The Job Done

HOW WE FILL "THE GAP"

Year	Global Petroleum Consumption	Crude Oil Supply	"Gap"	(%)
	---------- Million Barrels/day ----------			
1973	57.237	55.679	1.558	(3%)
1995	70.067	62.333	7.734	(11%)
2000	76.660	68.369	8.291	(11%)
2005	83.636	73.791	9.845	(12%)
2006	84.433	73.546	10.887	(13%)
2007*	85.494	73.160	12.334	(14%)

* First six months

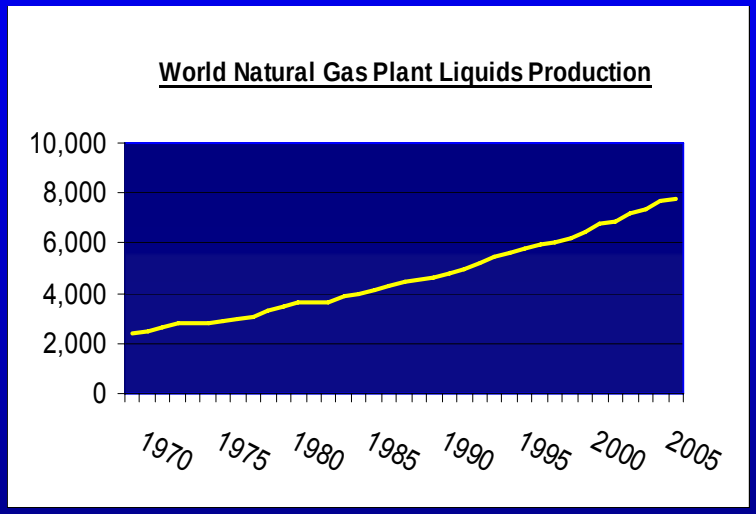
"GAP" = Natural gas liquids, refinery processing gains, inventory liquidation and tiny amount of synthetic crude/biofuel

Source: EIA

SIMMONS and COMPANY INTERNATIONAL

Growth In NGL Output Is Not Well Understood

- NGL growth occurring when crude oil began steady decline.
- Much of this growth comes from mature oilfields' expanding gas caps.
- These are not sources of sustainable growth.
- LNG projects also create by-product of NGL.
- It is "hard" to grow NGL volume by 1 – 2 MMB/D.
- Stealth growth in NGLs has masked declines in crude oil.



Oil Demand Outside OECD Growing Everywhere

- Driven by rapid population growth.
- Far more vehicles.
- Improving economies.

	2001	2006	Change	5-Year Increase (%)	
	---------- Million Barrels/Day ----------				
Egpyt	0.54	0.63	+.09	+17%	
South Africa	0.45	0.51	+.06	+13%	
Nigeria	0.25	0.29	+.04	+16%	
Argentina	0.44	0.5	+.06	+14%	
Venezuela	0.57	0.66	+.09	+16%	
India	2.29	2.58	+.29	+13%	
Indonesia	1.13	1.32	+.19	+17%	
Singapore	0.67	0.85	+.18	+27%	
China	4.67	6.69	+1.43	+43%	
Saudi Arabia	1.65	1.99	.34	+21%	
Total Non-OECD	29.15	33.95	4.8	+16%	3.1% per annum

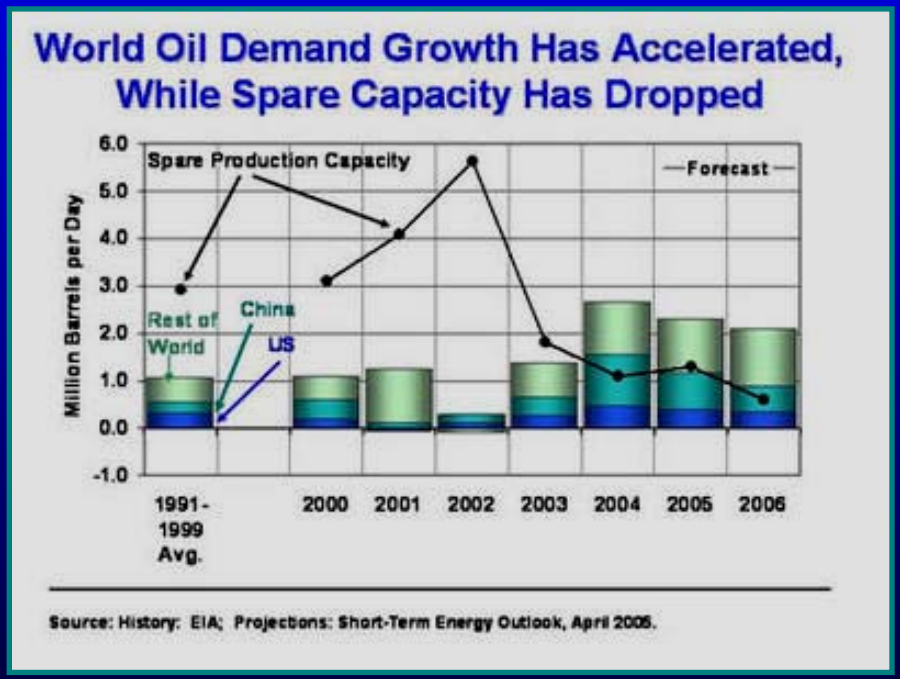
SIMMONS and COMPANY
INTERNATIONAL

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

Selected Country Sample	2001	2006	Change	Percent
	---------- Million Barrels/Day ----------			
USA	19.97	21.03	+1.06	+5%
Canada	2.06	2.23	+.17	+8%
Austria	0.26	0.3	+.04	+15%
France	2.05	1.96	(0.09)	-4%
Germany	2.81	2.66	(0.15)	-5%
Netherlands	0.89	1.01	+.12	+13%
Spain	1.49	1.59	+.10	+7%
UK	1.74	1.83	+.09	+5%
Japan	5.39	5.16	(0.23)	-4%
Australia	0.87	0.92	.05	+6%
Total OECD	47.90	49.22	+1.32	+3%

What Happens If Demand Outpaces Supply?

- Supply and demand live in two different worlds.
- Demand is fickle and not held back by tightening supply.
- When demand exceeds supply, we liquidate “stocks.”
- At some point, stocks drop below minimum operating levels.
- Then shortages begin.
- Shortages induce hoarding.
- Hoarding can suck our tanks dry.



SIMMONS and COMPANY INTERNATIONAL

Snapshot Of Key Oil Producers' Shrinking Discoveries

- 78 countries produce world's 72.5 MMB/D crude oil.
- 43 countries' production declined from 2005 – 2006*:
  - Average country decline rate was 6.7%
- 35 countries grew oil output in 2006 vs. 2005*:
  - Average country growth was 6.8%

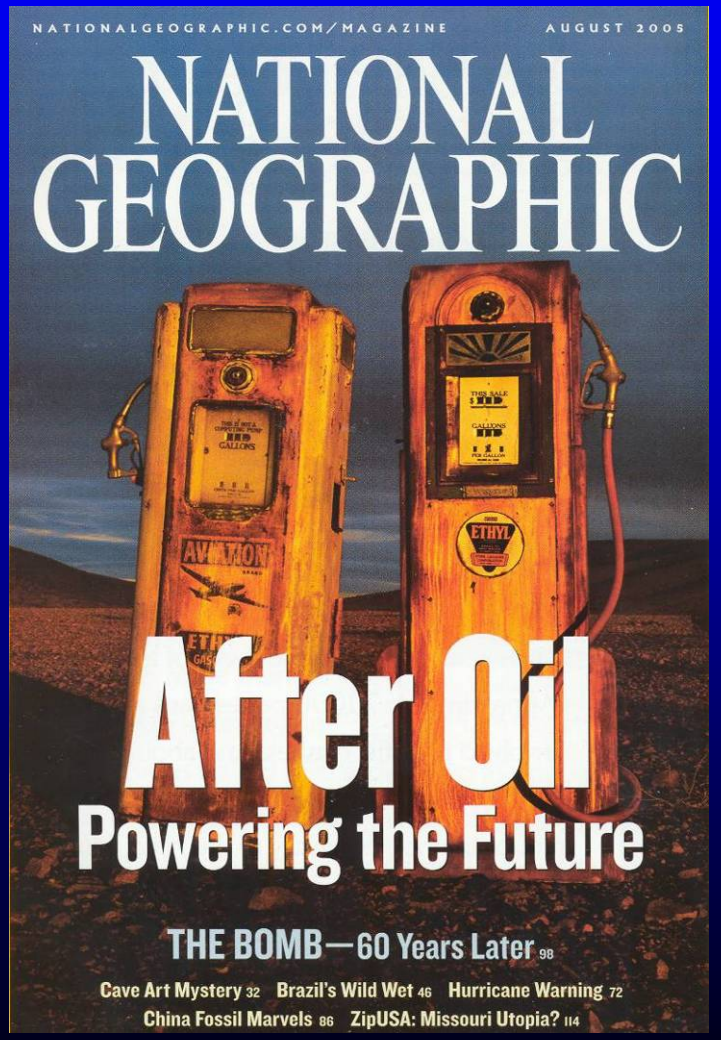
Fields Discovered	1990-1994	1995-1999	2000 - 2005
Angola	9	6	1
Australia	10	6	6
Brazil	20	11	1
Canada		0	
Colombia	21	7	2
Eduador	13	2	1
Egypt	14	24	1
Indonesia	12	14	1
Iran			
Malaysia	1		2
Mexico	1		
Nigeria	3	1	2
Norway	2	3	
Oman	11	7	
Thailand	3	4	
Trinidad & Tobago	4	3	2
U.K.	19	14	6
Total	143	102	25

Source: Oil & Gas Journal – December 18, 2006

SIMMONS and COMPANY INTERNATIONAL

Risk Management 101: Assume Peak Oil Has Arrived

- We insure homes against fires and floods with low chance of occurrence.
- But, the world has no plan for adopting a new economy if Peak Oil is real.
- If Peak Oil is not here already, its arrival is imminent.
- The higher demand grows, the faster the Peak becomes a steady decline.

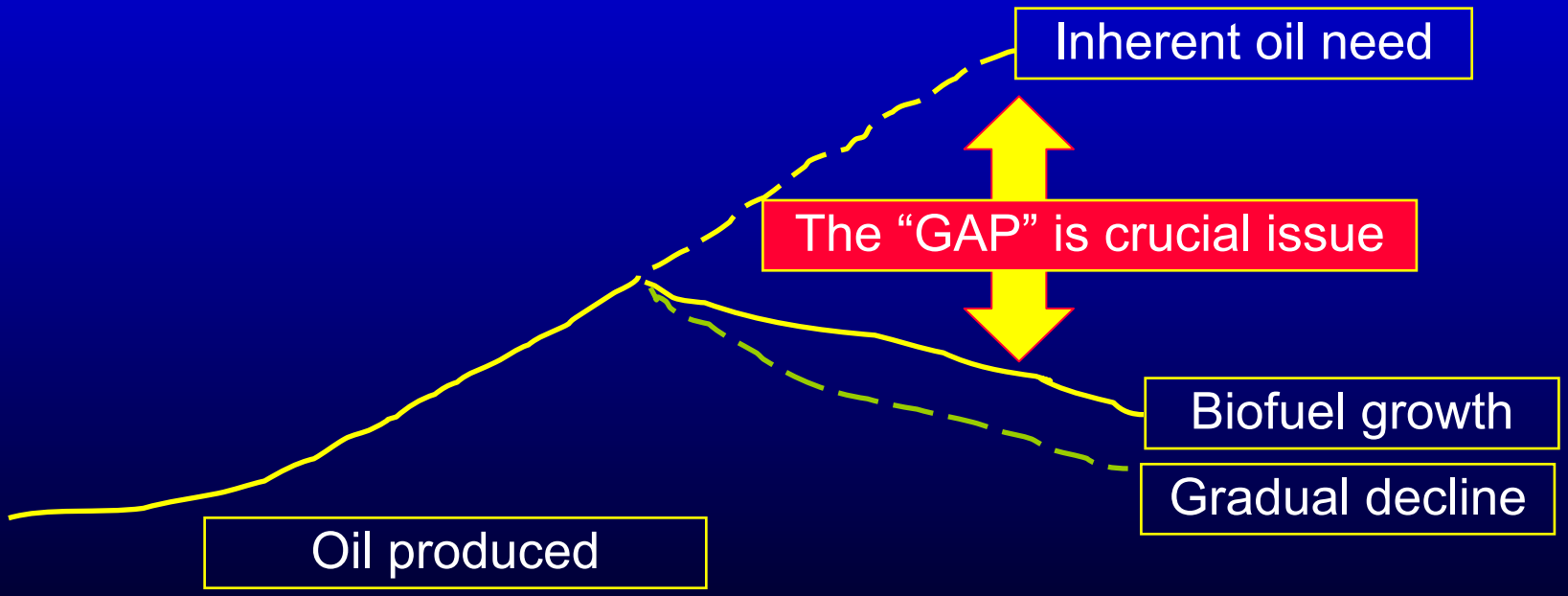


Could We Create "Radar" To Gauge Peak Oil

- Thus far, all regional peaks have been discovered after the fact.
- Lack of transparent key oil field production keeps us in a fog.
- World leaders could mandate accurate, timely field-by-field production reports.
- Levy mandatory $20/Bbl fine on exporting producers who fail to comply with transparency.
- This reform would create a Peak Oil radar system (and end the Peak Oil debate).

The Unforeseen Consequences Of Peak Oil

- It makes growth in oil demand an impossible dream.
- It soon leads to steady, irreversible oil decline.
- Oil will never "run out", but the risk of world only producing 60 – 65 MMB/day is high.



SIMMONS and COMPANY
INTERNATIONAL

Will Oil Demand Begin To Slow As Supply Shrinks?

- Oil supply and oil demand have no market linkage.
- Rapid rise in oil prices has yet to dent demand growth.
- As supplies falter, demand drains key stocks.
- When oil inventories reach minimum operating levels it is the equivalent of fuel tank reading empty.

The Big Risk: Shortages Appear

- If “min-op” inventories are breached, risk of shortages in some finished products is high.
- Once shortages begin, likely reaction is for users to hoard.
- Hoarding then creates a “run on the petroleum bank.”
- The problem then morphs into a nightmare.

How We Adjust To A Post-Peak Oil World

- We are forced to travel less:
  - Flexible work rules/performance pay could end long-distance commuting
  - Light rail advanced transportation system replaced or more highway lanes
- We need to grow food and produce goods at home:
  - Energy cost of “globalization” was unsustainable
- We need to invent new transportation fuels:
  - Need to be non-energy intensive
  - Scale to significant size
  - Be liquid (to use current 900 million vehicle fleet)

Can We Merely Switch To Other Energy Sources?

- Switching to other sources not easy.
- Useable proven natural gas could be scarce:
  - Too many gas basins now in decline
  - Too much stranded gas never discovered
  - Until natural gas proven abundant, only use is to generate heat
- Nuclear power will come back:
  - But, plants are expensive to build in energy terms
  - High quality uranium not abundant
  - Will only generate electricity (but very clean)
- Coal to liquids creates only sliver of new liquid supply.

Will Renewable Energy Save The Day?

- Solar, wind, hydro and geothermal provide only intermittent electricity.
- Most current biofuels laden with problems:
  - Upsetting the food chain
  - Energy intensive to create
  - Low quality end product
- On the horizon:
  - Cellulosity breakthroughs to wood-chips, switchgrass, etc.
  - Algae might be miracle product fuel source
  - OTEC created liquid ammonia?
- Can any happen fast and to scale to be globally relevant?

SIMMONS and COMPANY
INTERNATIONAL

How To Enlist To Fight Our Energy War

- If world ignores the Peak Oil issue, chaos will rule the day.
- Oil has played prominent role in most 20th century wars.
- Post-Peak Oil scramble could create our final war.


It behooves all of us to take the risk of Peak Oil seriously, clamor for better energy transparency, and join in solving what could be the 21st century's greatest challenge and biggest risk.

SIMMONS & COMPANY INTERNATIONAL

Investment Bankers *to the* Energy Industry

For information and/or copies regarding this presentation, please contact us at (713) 236-9999 or lrussell@simmonsco-intl.com. This presentation will also be available on our website www.simmonsco-intl.com within seven business days.