

# ***"The End of Cheap Oil: Are you ready?"***

**Council of Supply Chain Management Professionals  
Saint Louis Roundtable - Annual Seminar  
February 17, 2011**

**Chuck Taylor  
Founder and Principal of Awake! Consulting**



Council of Supply Chain  
Management Professionals

# Today's Agenda.

**Peak Oil Explanation**

**Oil Supply Outlook**

**Geopolitics**

**Oil Industry**

**Alternatives**

**Demand Outlook**

**What To Expect**

**Mitigation Strategies**

**Peak Oil Checklist**

# What is a Predictable Surprise?

**Warning signs which people did not want to see or face.**

**Events catch leaders off guard, even though they had all the information necessary to anticipate them.**

**A pervasive failure of leadership with grave consequences for individuals, organizations, and society.**

Sources: Mike Regan, Transact Technologies

“Predictable Surprises: The Disasters You Should Have Seen Coming And How To Prevent Them.”

Max H. Bazerman and Michael D. Watkins

# Attributes of Predictable Surprises.

**Knew a problem existed that would not solve itself.**

**The problem is getting worse over time.**

**Fixing the problem incurs significant present costs to avoid costs that are uncertain, but likely to be much larger.**

**Avoiding requires a decision to act to change the status quo.**

Sources: Mike Regan, Transact Technologies

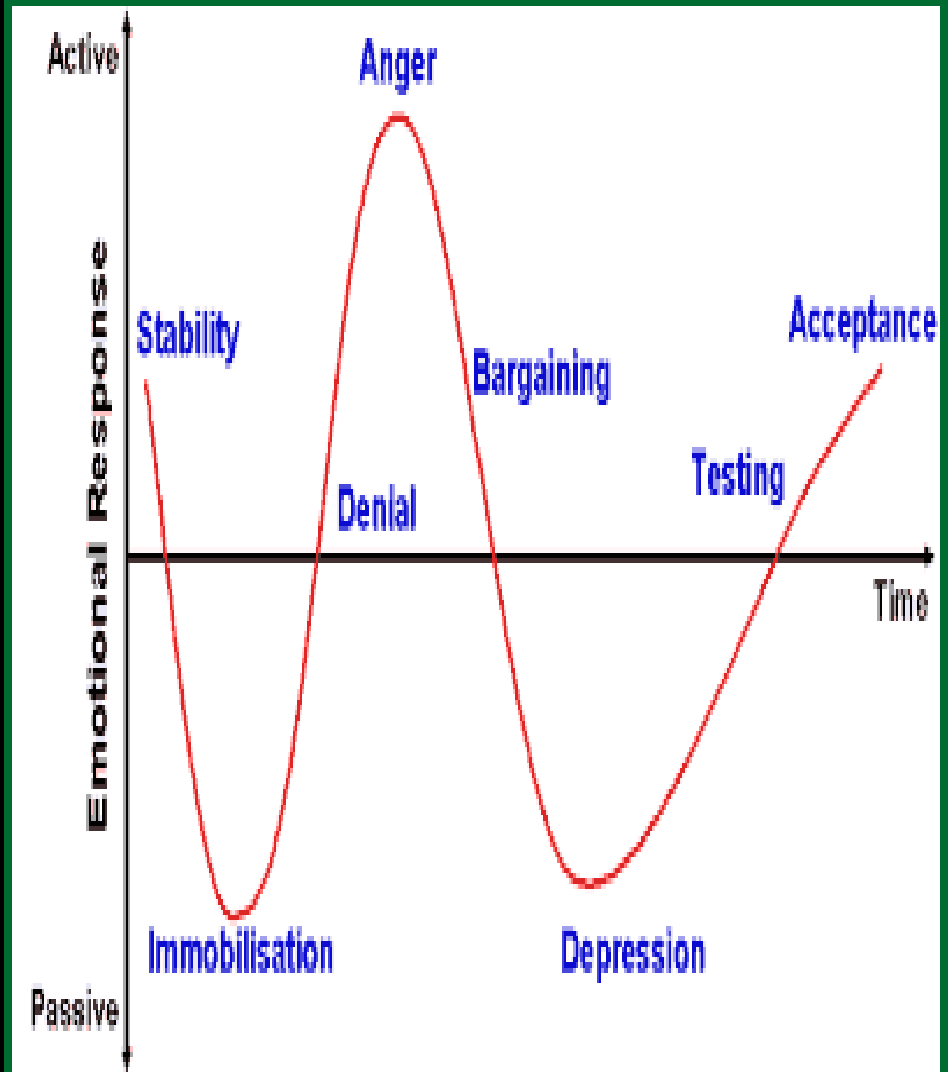
“Predictable Surprises: The Disasters You Should Have Seen Coming And How To Prevent Them.”

Max H. Bazerman and Michael D. Watkins

# Dealing with the wolf!



Coming to a civilisation near you



# Much Confusion...

**ALL NEW!**  
• SHOCKING!  
• BIZARRE!  
• INCREDIBLE!  
and it's ALL TRUE!

**WEEKLY WORLD NEWS**  
THE WORLD'S ONLY RELIABLE NEWSPAPER

WHAT THE GOVERNMENT DOESN'T WANT YOU TO KNOW ...

# NO MORE OIL!

**WORLD SUPPLY WILL BE GONE IN 6 MONTHS**

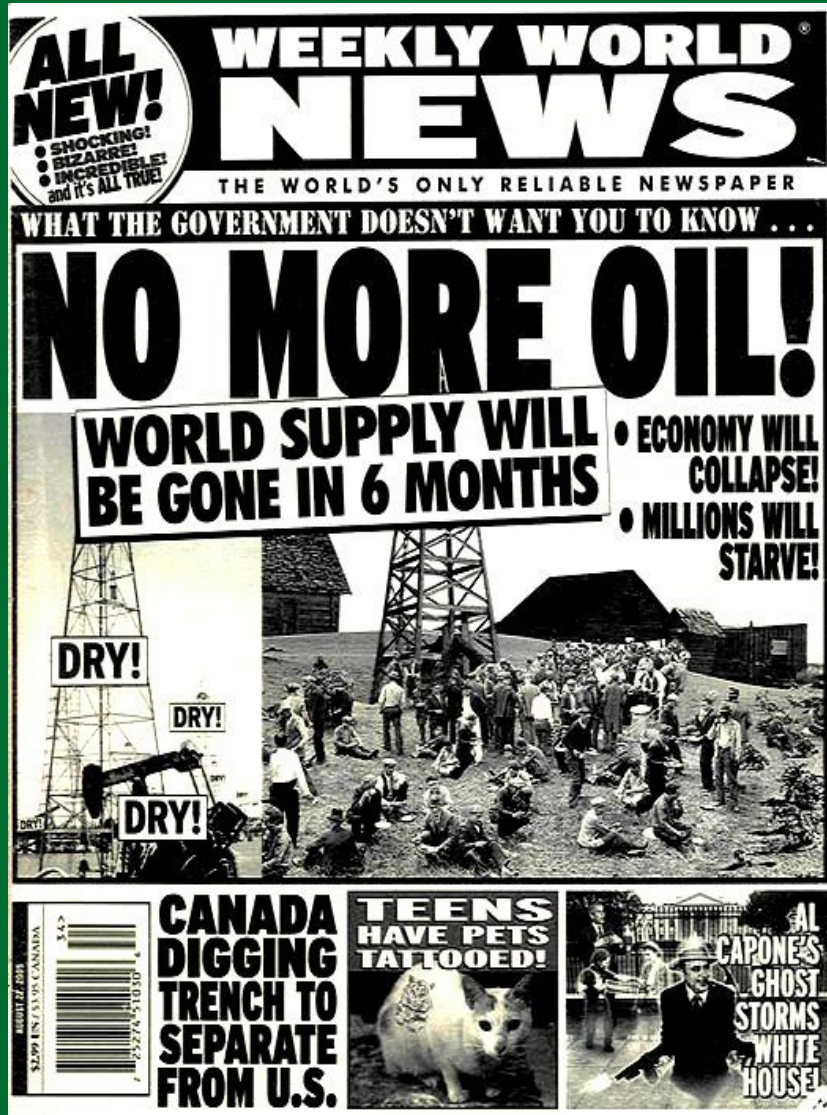
- ECONOMY WILL COLLAPSE!
- MILLIONS WILL STARVE!

**DRY!**  
**DRY!**  
**DRY!**

**CANADA DIGGING TRENCH TO SEPARATE FROM U.S.**

**TEENS HAVE PETS TATTOOED!**

**CAPONE'S GHOST STORMS WHITE HOUSE!**



**DOUBLE HOROSCOPE!**  
Top psychics team up for the most accurate horoscope ever!

**WEEKLY WORLD NEWS**  
April 11, 2002

**Teen buys nuke off the Internet!**

**DOUBLE ISSUE!**

# OIL FOUND ON MOON!

*Gas prices will fall to 10¢ a gallon as Arab oil becomes obsolete!*

PLUS - SPECIAL SECTION!

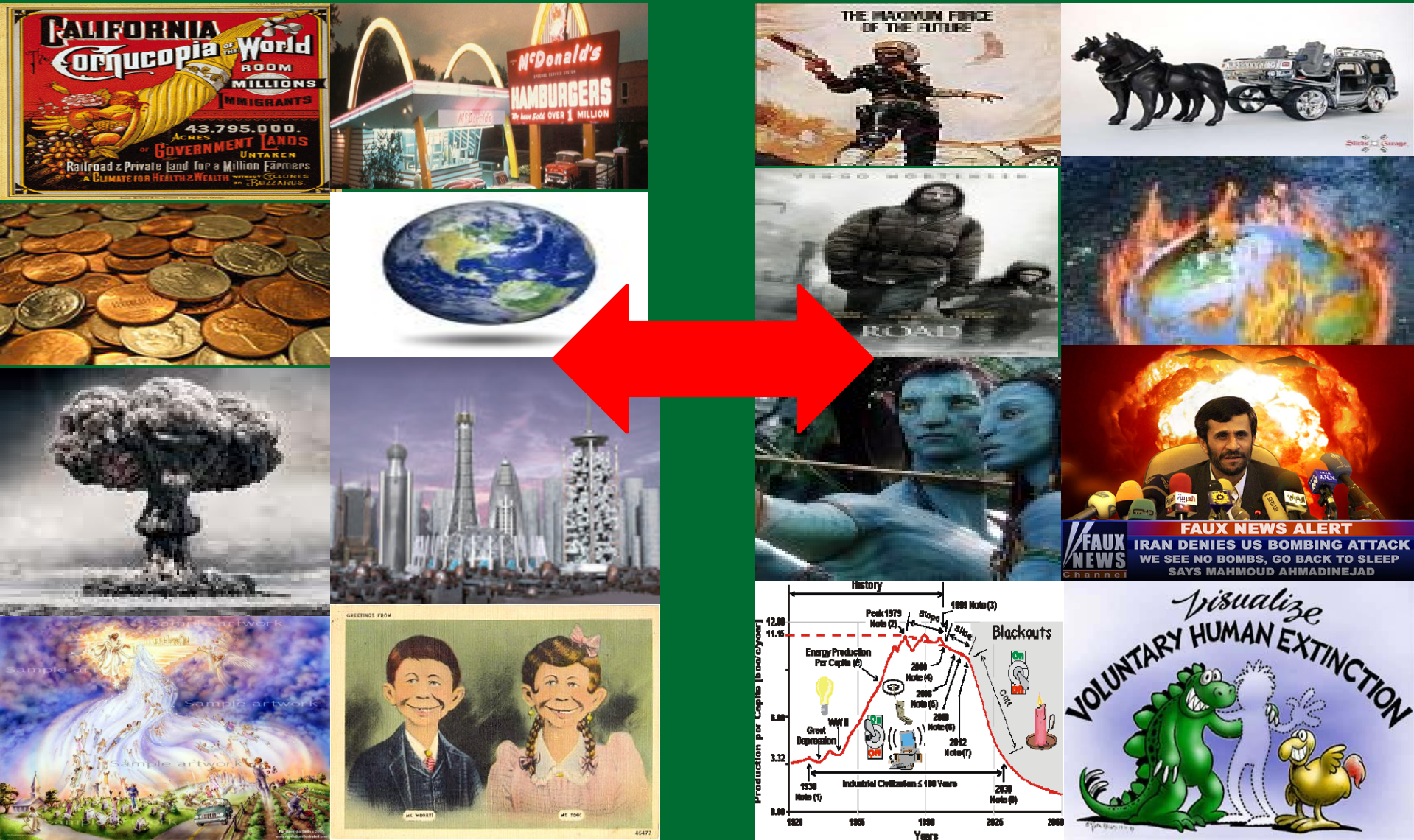
# AMERICA AT WAR

- MEET IRAQ'S NEXT LEADER!
- Al Qaeda's new flatulence weapon!
- 'Gorilla' warfare in Iraq - & MUCH MUCH MORE!





# ...leads to many opinions.



# Good Rule.

**“Data always beats theories.”**

**Matt Simmons, President and CEO, Simmons and Co.  
International.**



# **Conventional Oil is...**

- ...a non-renewable produced in only two geological periods.**
- ...only found if five very specific conditions are present.**
- ...found in a few unique places – most long since explored.**
- ...not created equal.**

# **Conventional Oil is...(Cont.)**

- ...found, brought to the surface, refined and moved before it is used.**
- ...the highest energy density of any portable energy storage medium.**
- ...the energy all other energies are ranked against in terms of utility, consistency, safety and price.**
- ...alternatives needs to be as cheap and substitutable.**

**"Peak-oil theory is garbage as far as we're concerned."**

Robert W. Esser, Director of Cambridge Energy Research Associates (CERA).  
*Business Week Online*, Sept 7, 2007.

**"'Peak Oil' Is a Waste of Energy."**

Michael Lynch, Energy Consultant, *New York Times* Op-Ed, August 24, 2009.

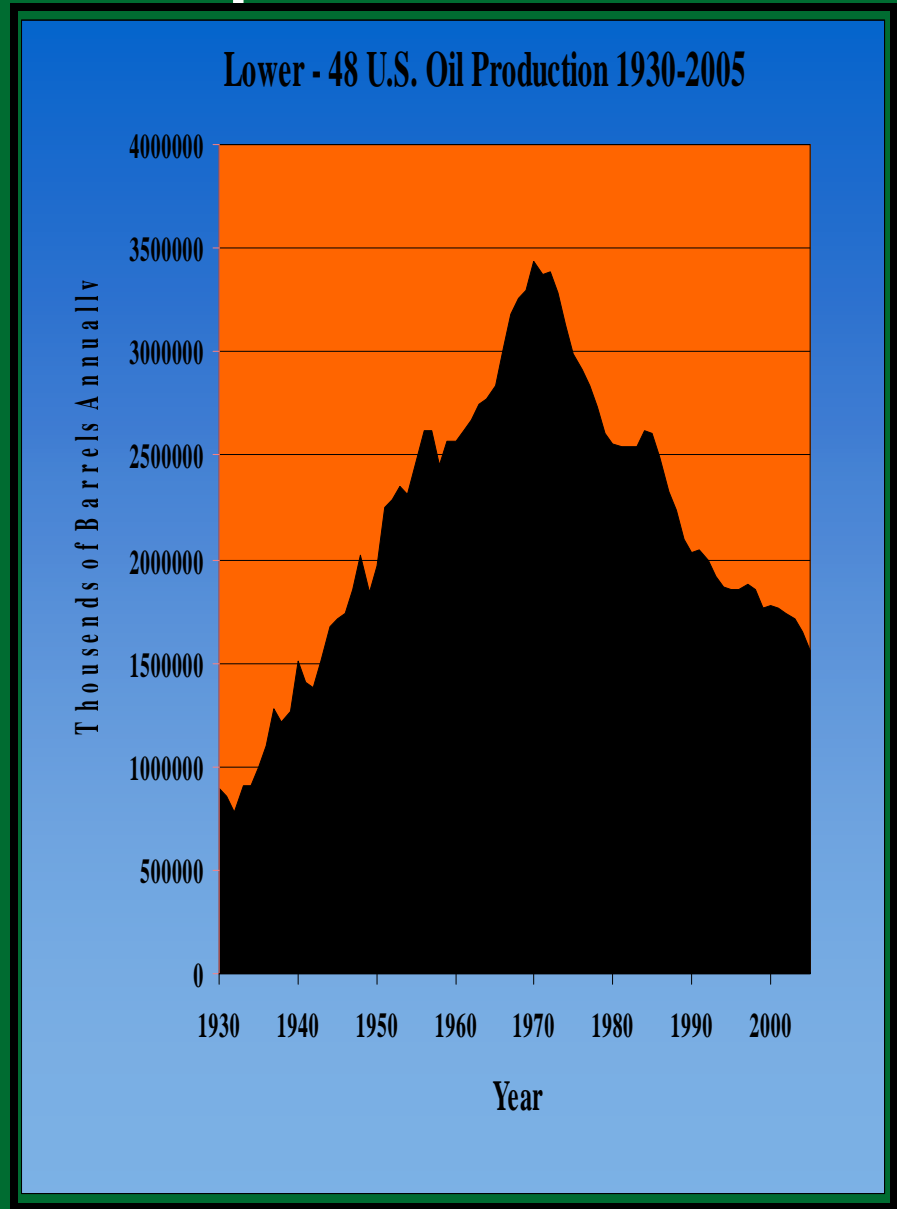
**"...the awful day of 'peak oil' production...is still a long way off".**

Daniel Yergin, CEO CERA, *Wall Street Journal*, "Energy Guru Brings Good News to Davos", January 27, 2010.

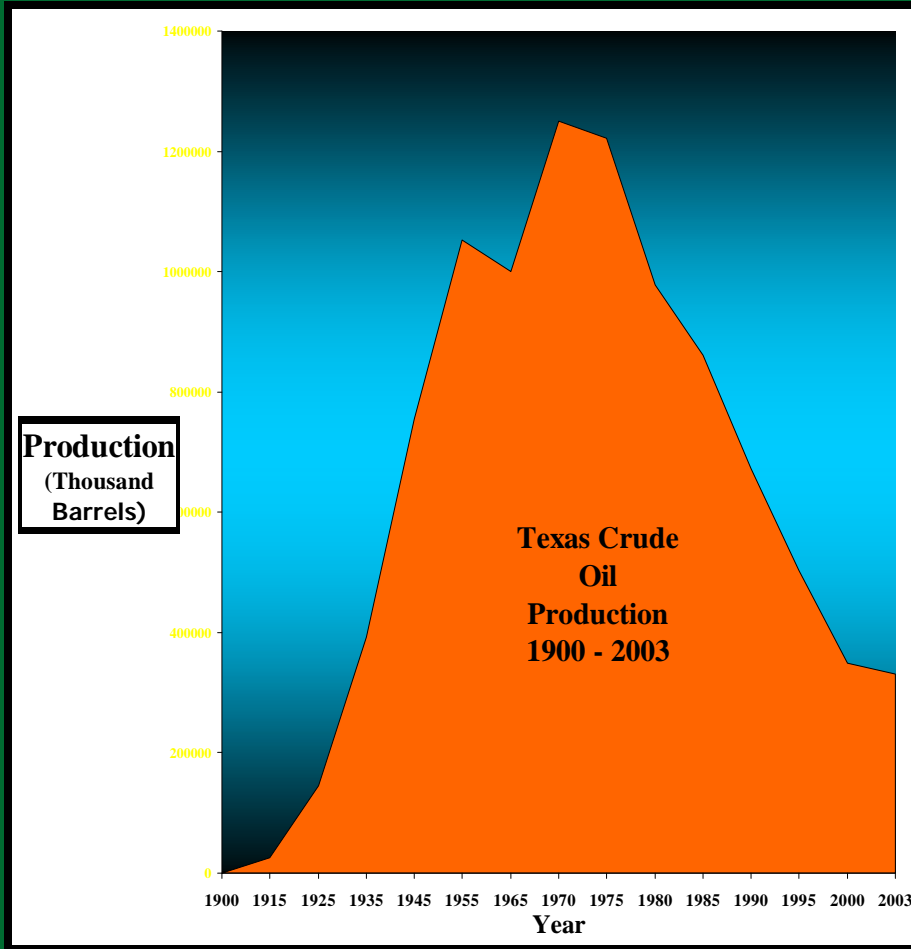
**"There is too much rhetoric in the public domain about moving away from oil".**

Khalid Al Falih, CEO Saudi Arabian Oil Co. article *Dow Jones Newswires*,  
"Chief: Plentiful Supply Trumps 'Peak Oil' January 28, 2010.

**In 1956, Dr. M. King Hubbert predicated  
U. S. Oil Production would peak in 1970.**



# I saw it happen!



## 1962-1972 Texas

Price stable, up slightly

Production +40%

## 1972-1982 Texas

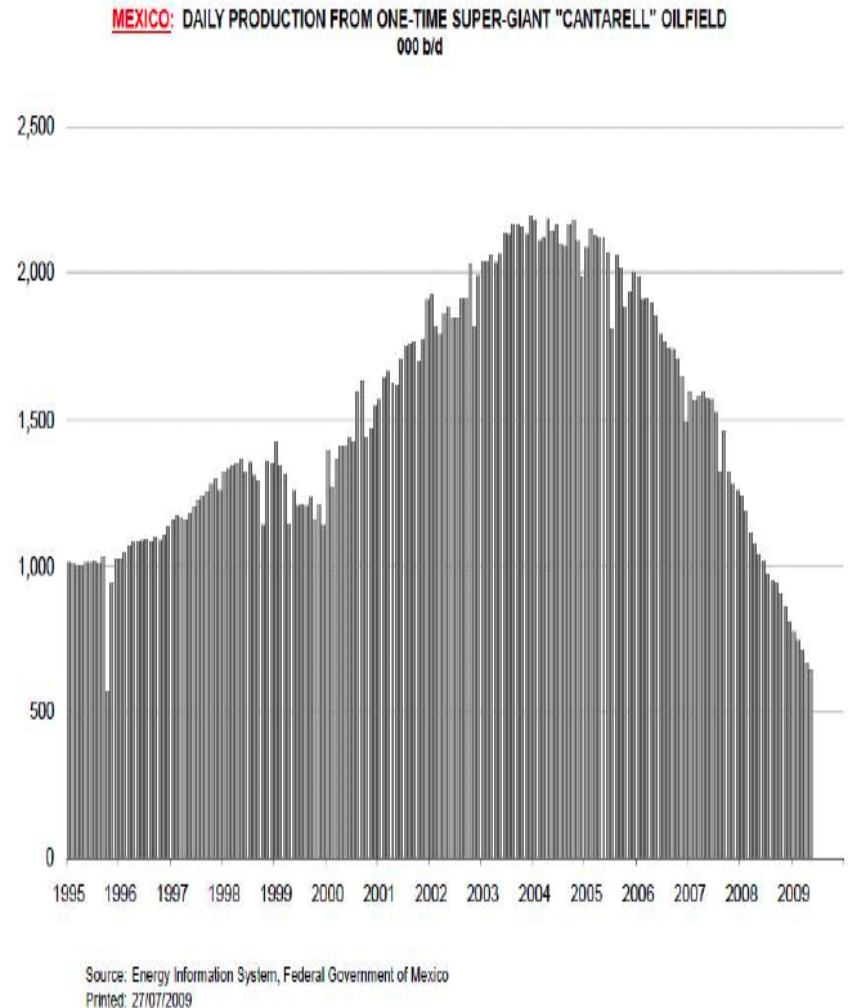
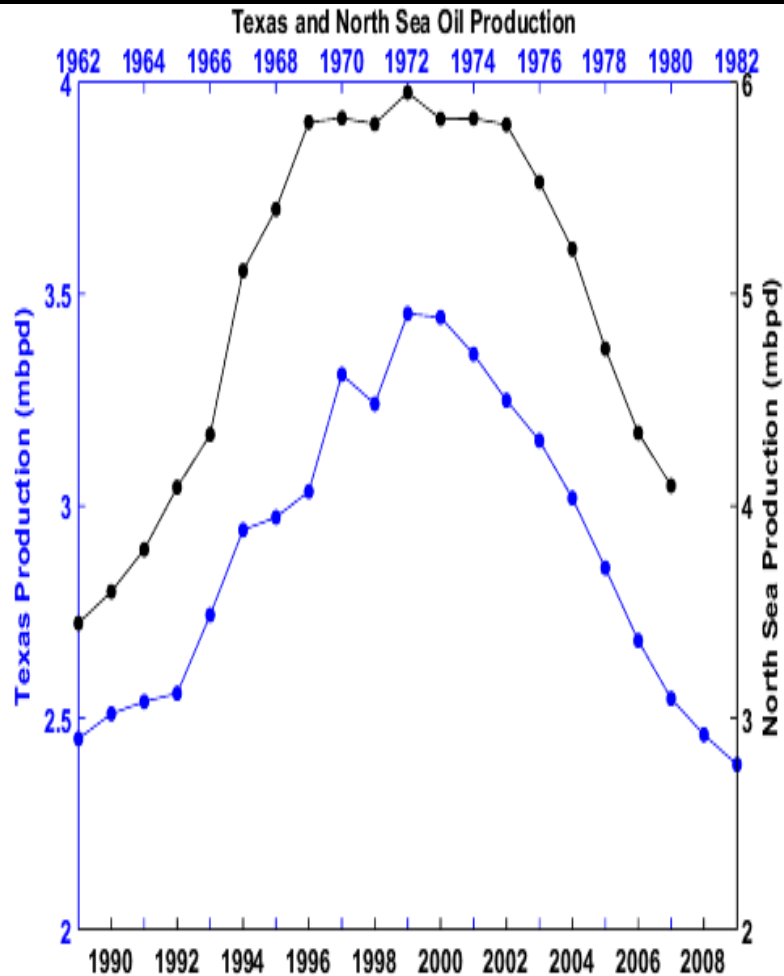
Drilling exploded

Price +1000%

Production -28%



# It happens in every oil field.



# Timing is the only question for most.

| Peak 2005 to 2012            | Peak 2011 to 2021             | Peak after 2021     | “Peak Oil is garbage”   |
|------------------------------|-------------------------------|---------------------|-------------------------|
| E.T.Westervalt.....2005      | German Army.....2010/11       | PFC Energy.2020/25  | CERA....Well after 2020 |
| S.Bakhtiari.....2005         | Oxford University.....2014    | Amarach.....2021    | Exxon Mobil.....No sign |
| M. Simmons.....2005          | Kuwait University.....2014    | UBS.....Mid- 2020's | BP.....Can't predict    |
| T. Boone Pickens .....2005   | UK Industry Taskforce..2015   |                     | OPEC.....Deny theory    |
| K.Deffeyes..... ..2005       | U.S. Joint Forces.....2012/15 |                     | Michael Lynch....Never  |
| K. Aleklett.....2005         | U.S. DoE (IEA).....2011/15    |                     |                         |
| R.Herrera.....Close          | S .Al Hussein.....2015        |                     |                         |
| H. Groppe.....Soon           | Merrill Lynch..... 2015       |                     |                         |
| Macquarie Bank..... 2009     | Volvo Trucks.....2016         |                     |                         |
| S.Wrobel.....2010            | C. De Magerie.....2016        |                     |                         |
| R. Bently.....+/-2010        | F. Robelius.....2008/18       |                     |                         |
| C. Campbell.....2010         | Charles Maxwell.....2020      |                     |                         |
| L. Meling.....2011           | Wood Mackenzie.....2020       |                     |                         |
| R. Koppelear..... +/-2012    | Total.....2020                |                     |                         |
| C. Skrebowski.. ....+/- 2012 | Fatlh Bariol.....2020         |                     |                         |

# Growing Consensus.

***“The actual global supply of oil is now expected to be limited to 91-92 million barrels per day ...by the end of 2010/early2011.”***

"The Oil Crunch: A wake-up call for the UK economy." United Kingdom Industry Taskforce on Peak Oil and Energy Security. February, 2010.

***“The world's oil reserves had been exaggerated by up to a third, demand may outstrip supply as early as time period of 2014-2015.”***

Smith School of Enterprise and the Environment - Oxford University., March 2010.

***“The analysis of 47 major oil producing countries estimates ...peak in 2014...OPEC has...about 78% of the world reserves.”***

College of Engineering and Petroleum at Kuwait University, March 2010.

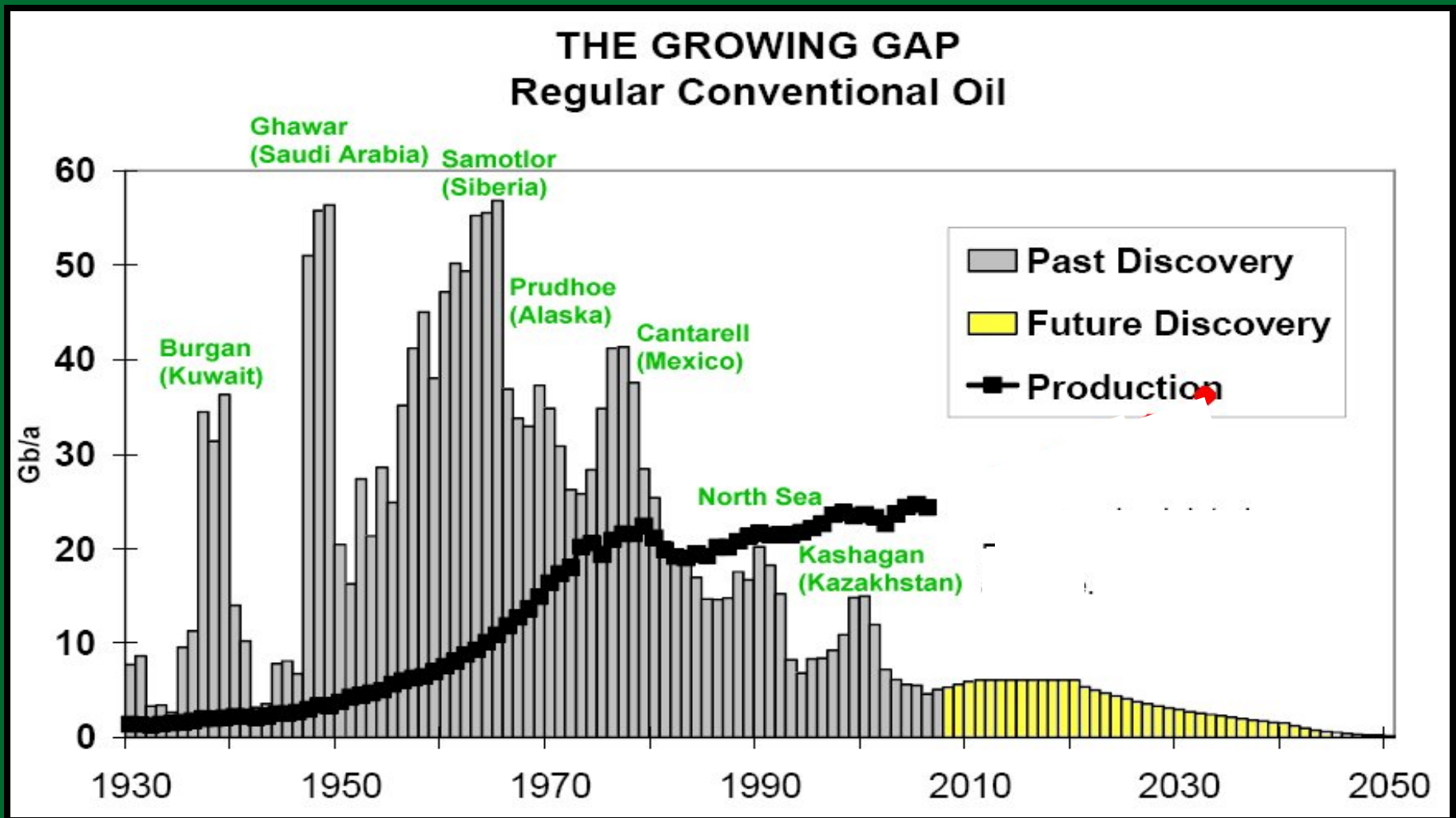
***“By 2012, surplus oil production capacity could entirely disappear, and as early as 2015, the shortfall could reach nearly 10 million barrels per day.”***

U.S. Joint Forces Command released its Joint Operating Environment 2010 Report, March 2010.

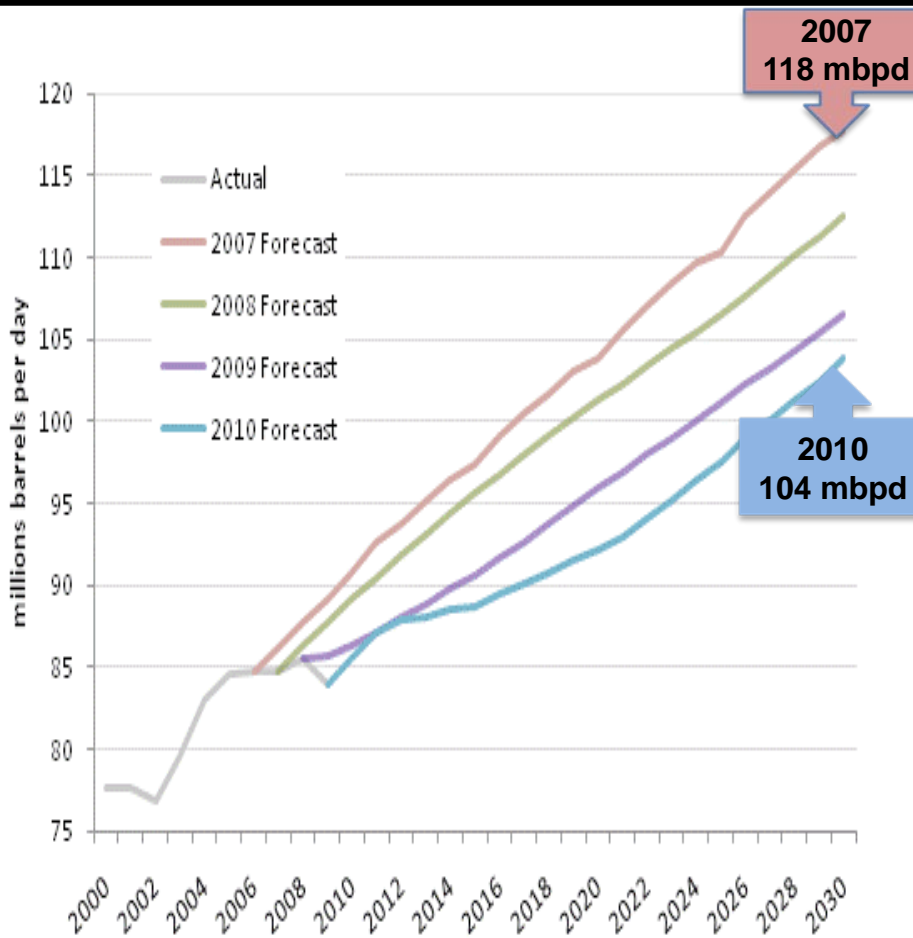
***“The risks to security posed by such a development cannot even be estimated.”***

German Army Report, September, 2010.

# A growing gap between discoveries and production.



# The Incredible Shrinking Forecast.



**Since 2005, IEA had reduced the 2030 projected daily world oil production from 120 mbpd to 105 mbpd in 2009.**



**“Global oil production reaches 96 mbpd in 2035 on the back of rising output of natural gas liquids & unconventional oil, as crude oil production plateaus.”**

**2010 World Energy Outlook**



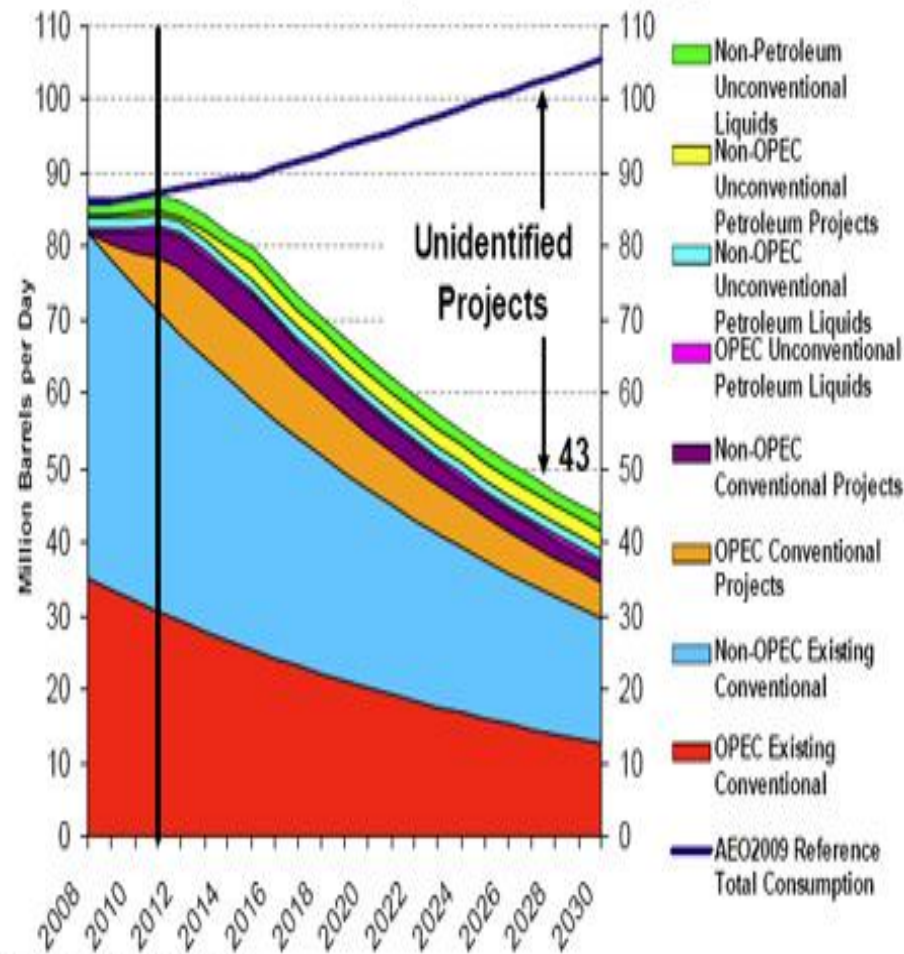
**Energy Information Administration**

Official Energy Statistics from the U.S. Government



# Need a new Saudi Arabia every 2 years.

World's Liquid Fuels Supply



Source: EIA, AEO2009

## The Challenge.

Current Production: **87**

Million Barrels Per Day

Depletion: 5.0%: **4.4**

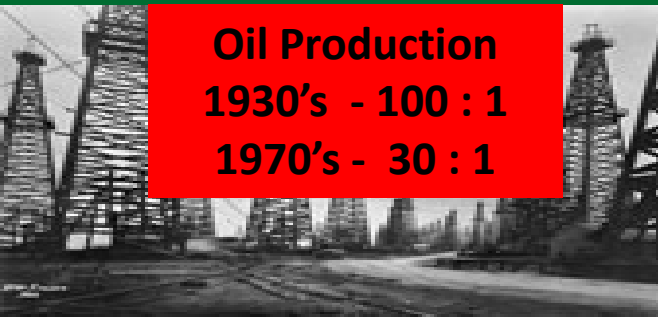
Demand : 1.5%: **1.3**

Total Needed Annually: **5.7**

Saudi Production : **11.0**

(including spare capacity)

# Energy Returned on Energy Invested. (EROEI)



**Oil Production**  
1930's - 100 : 1  
1970's - 30 : 1



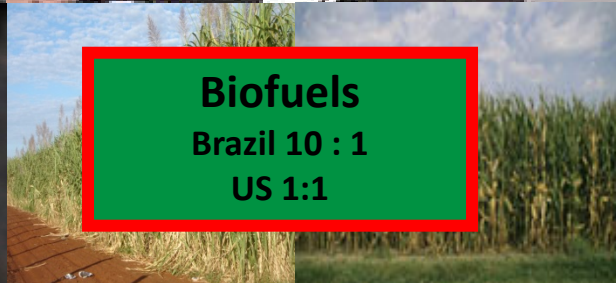
**Oil Production**  
Today - 19 / 10 : 1



**Deep Water**— 8 : 1



**Canadian tar sands** — 5/3 : 1.



**Biofuels**  
Brazil 10 : 1  
US 1:1



**Shale** - na

**These keep the fleets moving.**

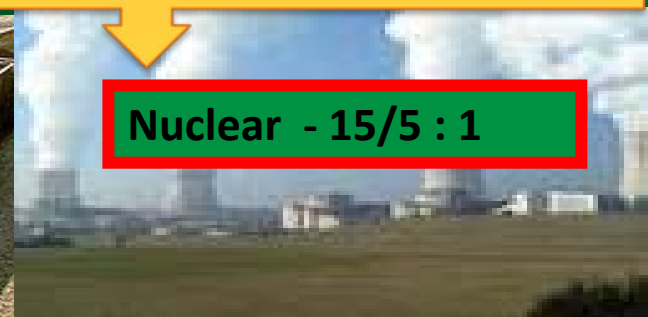
**These keep the lights on.**



**Coal** - 80/50 :1



**Natural Gas** - 10:1



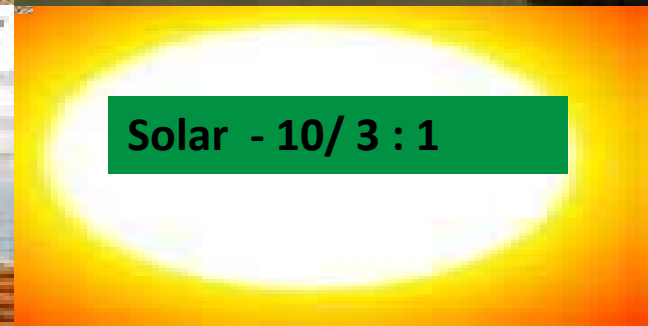
**Nuclear** - 15/5 : 1



**Hydro** — 100 : 1



**Wind** - 18 : 1

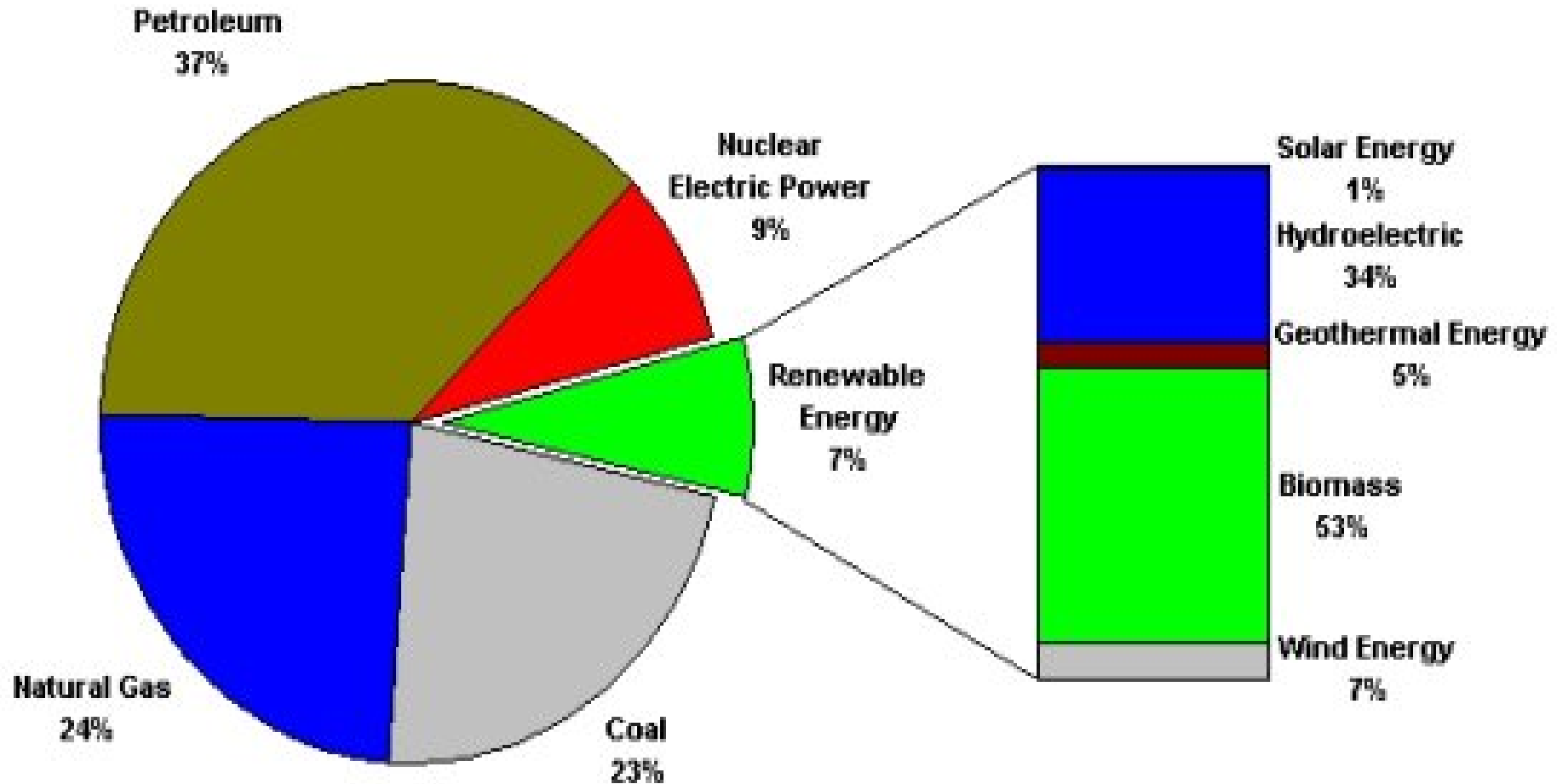


**Solar** - 10/ 3 : 1

# No present alternatives for oil for transportation.

Total = 99.305 Quadrillion Btu

Total = 7.301 Quadrillion Btu



**Energy Information Administration**

Official Energy Statistics from the U.S. Government

# Think about it!



**1 Cup = \$1.18**

**VS.**



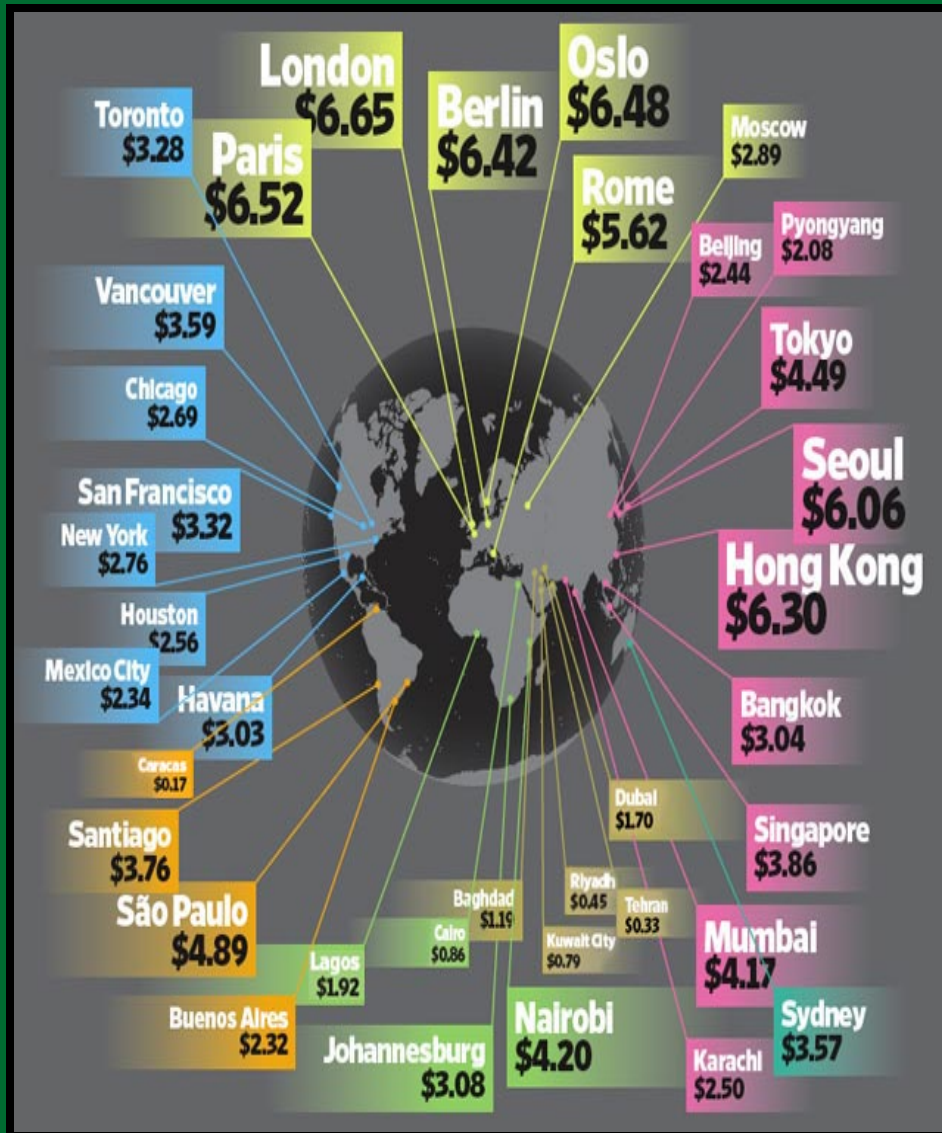
**1 Cup = \$0.33**

**One barrel of oil has the energy of up to 25,000 hours of human labor.**

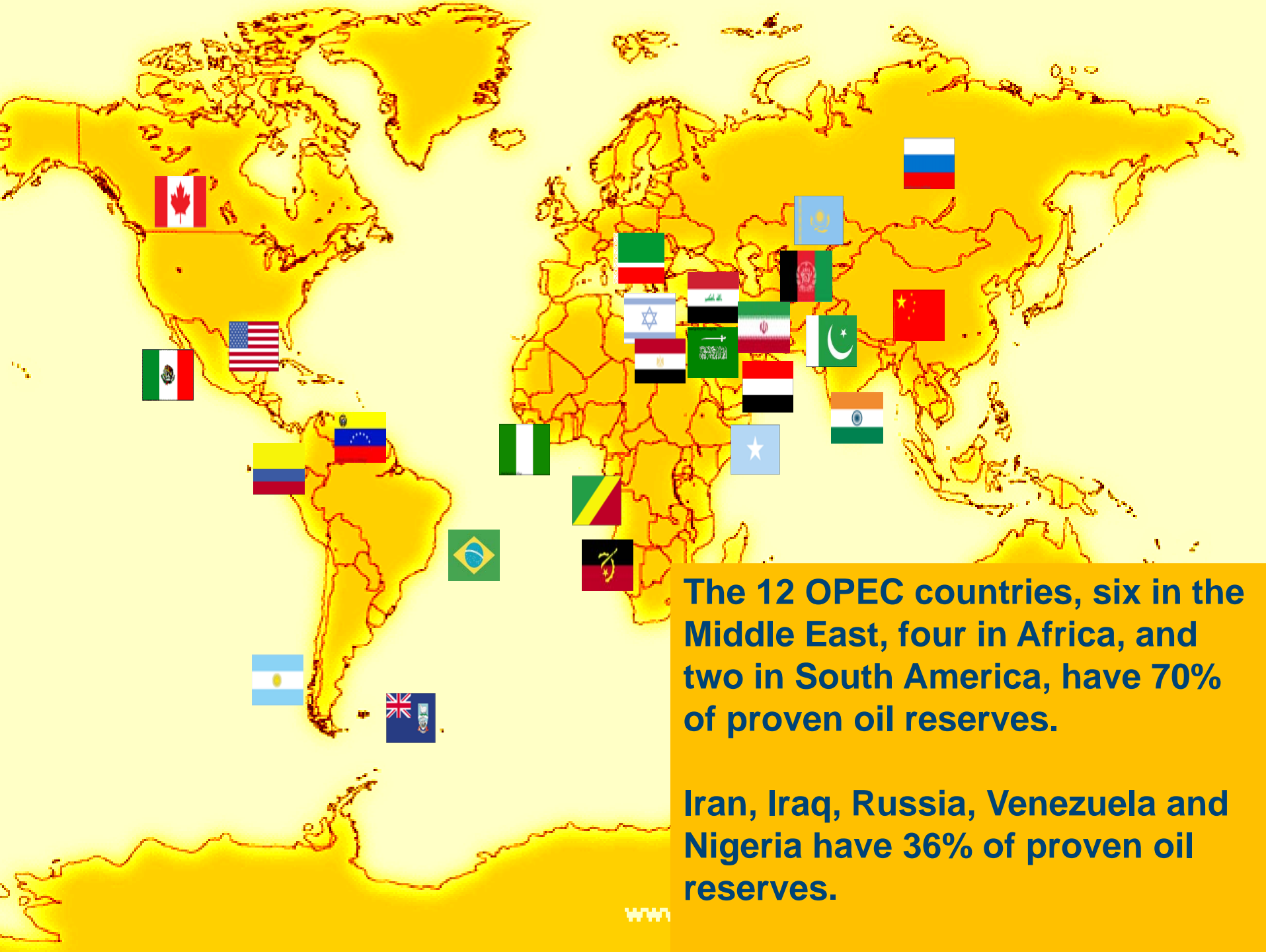
**Even at \$100 a barrel, oil is remarkably cheap compared with human labor.**



# World Gasoline Prices and Taxes.

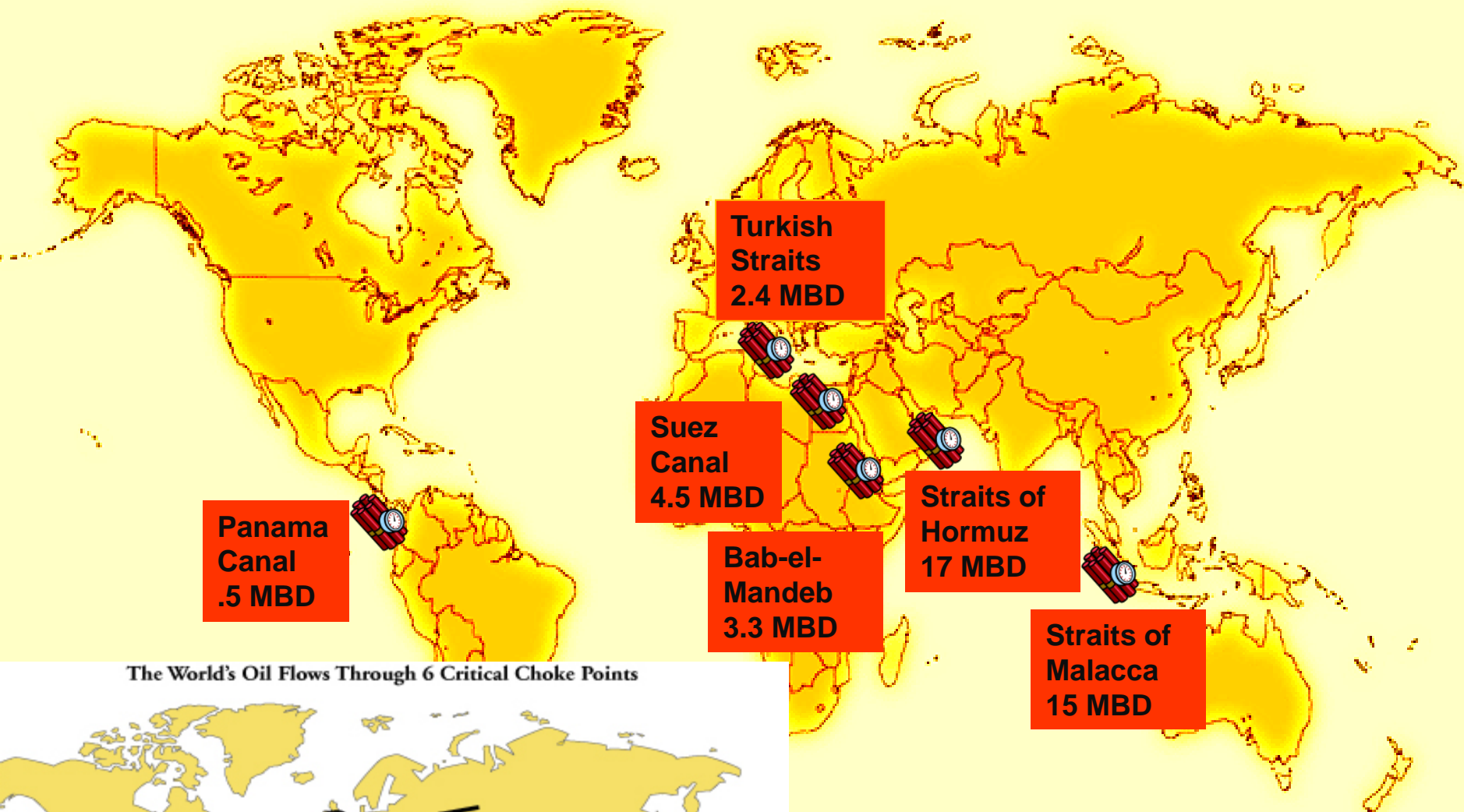




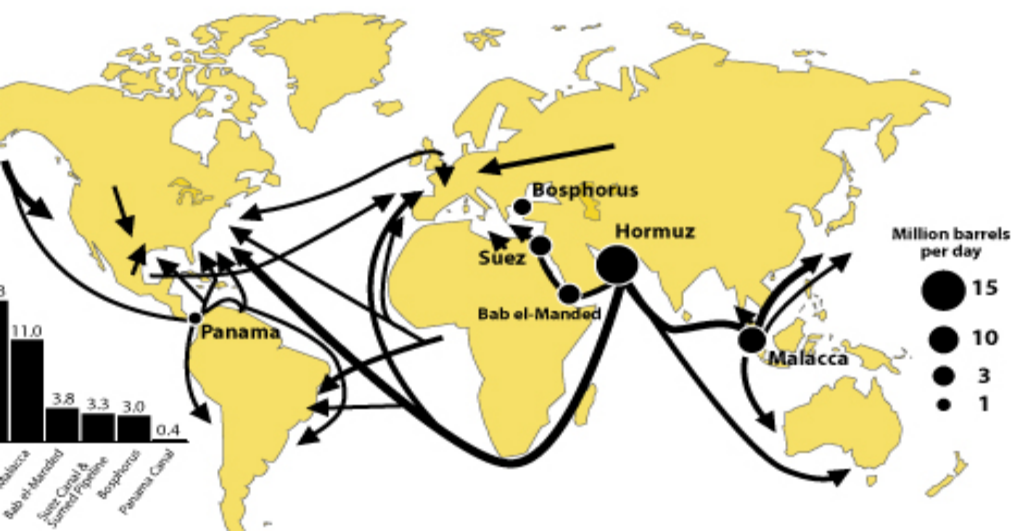


**The 12 OPEC countries, six in the Middle East, four in Africa, and two in South America, have 70% of proven oil reserves.**

**Iran, Iraq, Russia, Venezuela and Nigeria have 36% of proven oil reserves.**



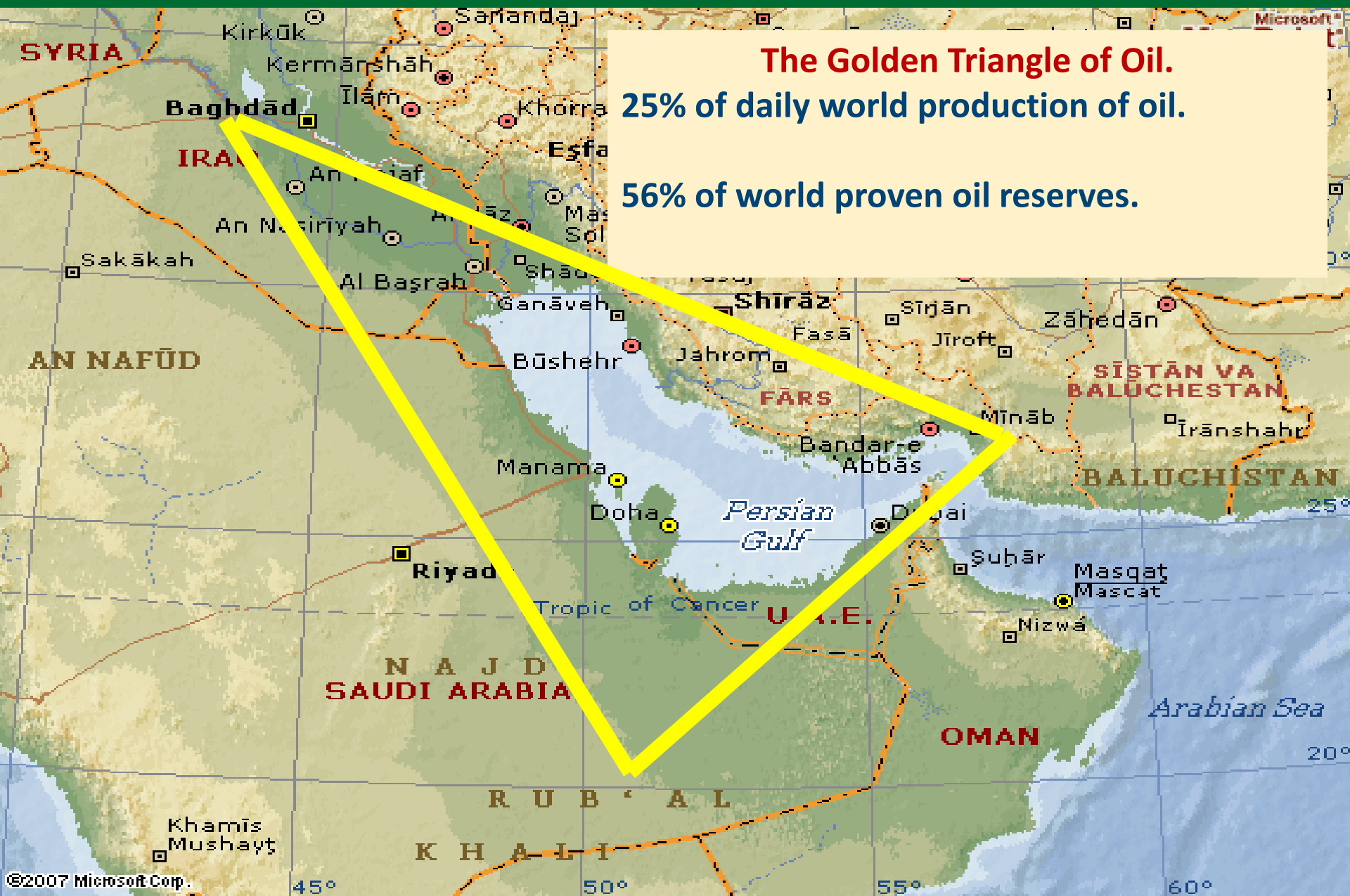
The World's Oil Flows Through 6 Critical Choke Points



## Oil Choke Points:

Source: Department of Defense

# It all about the Middle East!



**The Golden Triangle of Oil.**

**25% of daily world production of oil.**

**56% of world proven oil reserves.**

# World's Oil Gauge is Broken.

250 of world's fields provide 80%+ of total production.

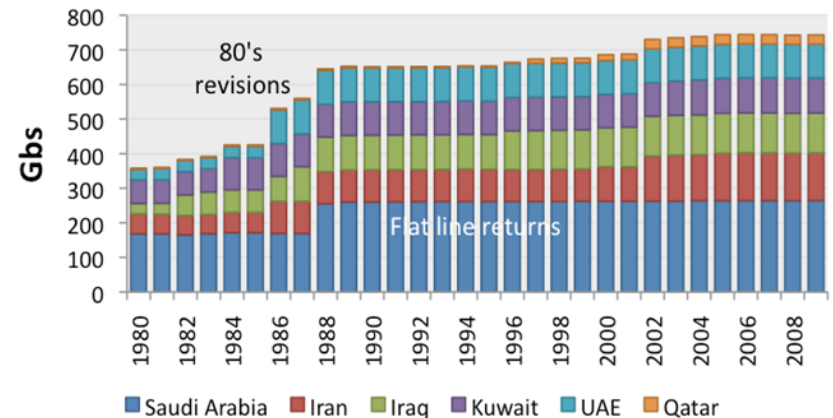
95% of world's "proven reserves" are unaudited.

Current numbers not accurate.

Many analyst agree with WikiLeaks - ME reserves overstated.

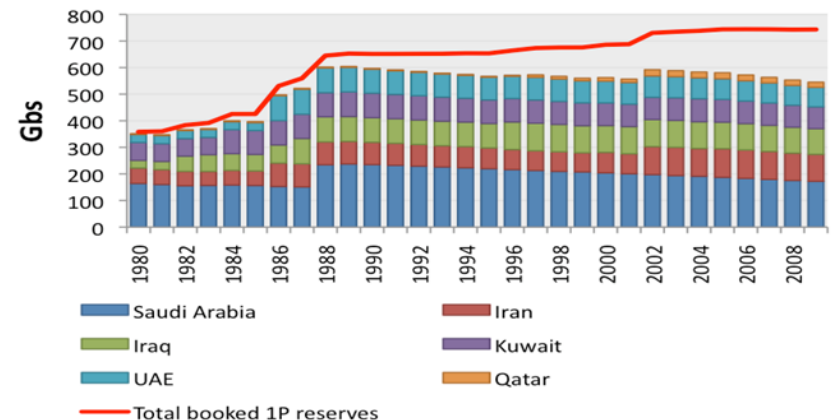
Few know true condition of reservoirs.

Middle East OPEC Oil Reserves



E. Mearns 2010

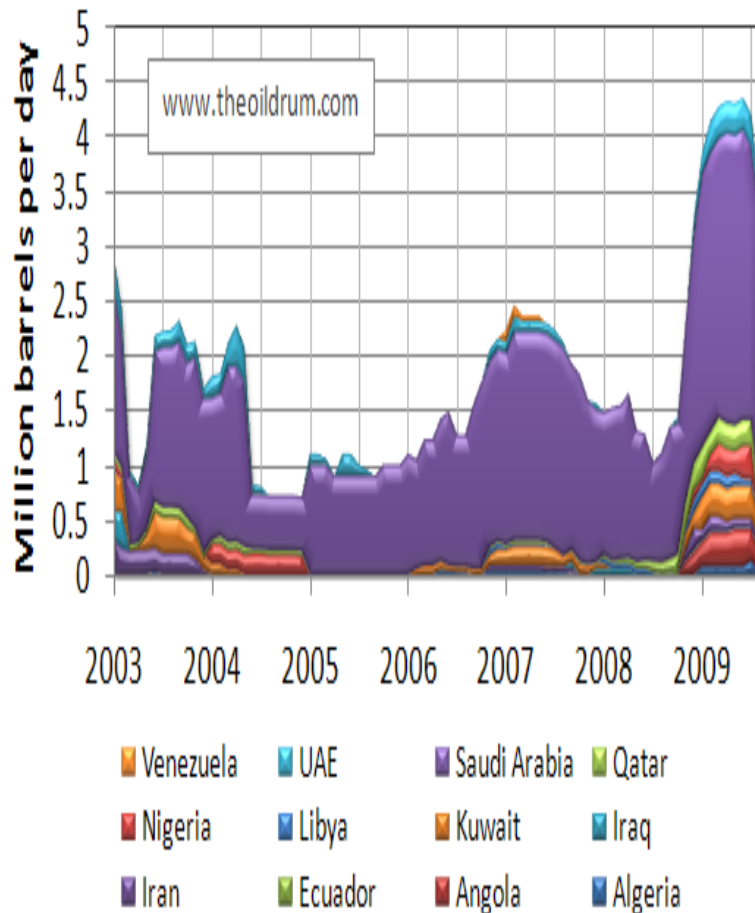
Middle East OPEC Oil Reserves  
adjusted for production



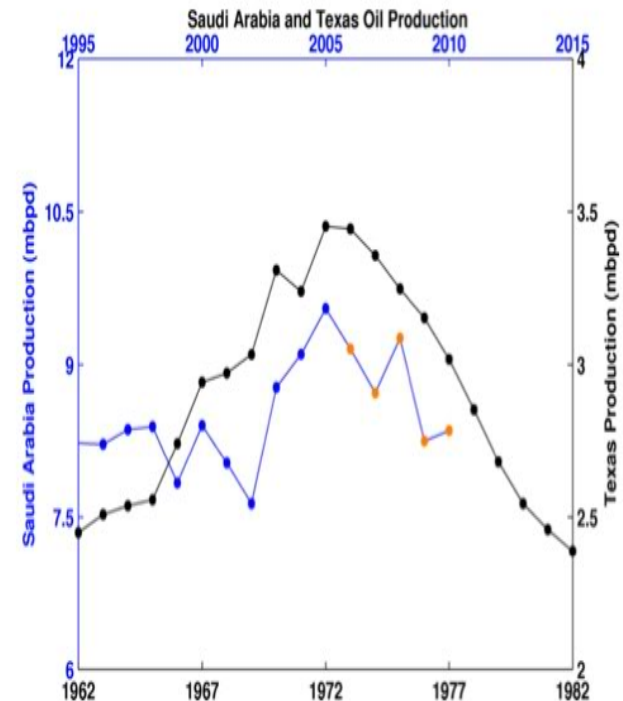
E. Mearns 2010

# Supposed excess capacity is in Saudi Arabia.

## OPEC spare capacity according to EIA



## Texas and Saudi Production



Source: Jeffery Brown, *The Oil Drum*



# When Saudi Arabia peaks the world peaks.

Five old super giant fields have produced 90% of SA's oil. All face serious water maintenance and corrosion problems.

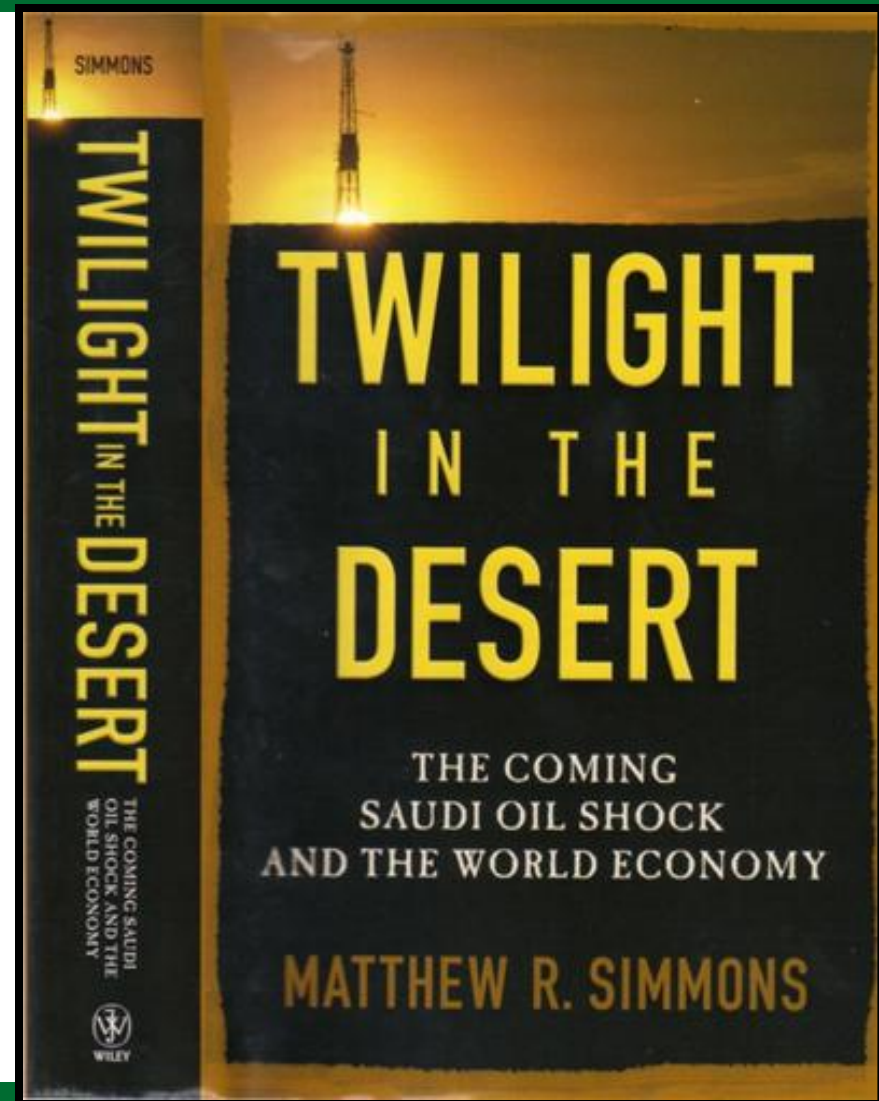
35 years of intense exploration found little new oil. Drilling cost up 7 times since 2004.

**“The West is deluded to rely on Saudi oil.”**

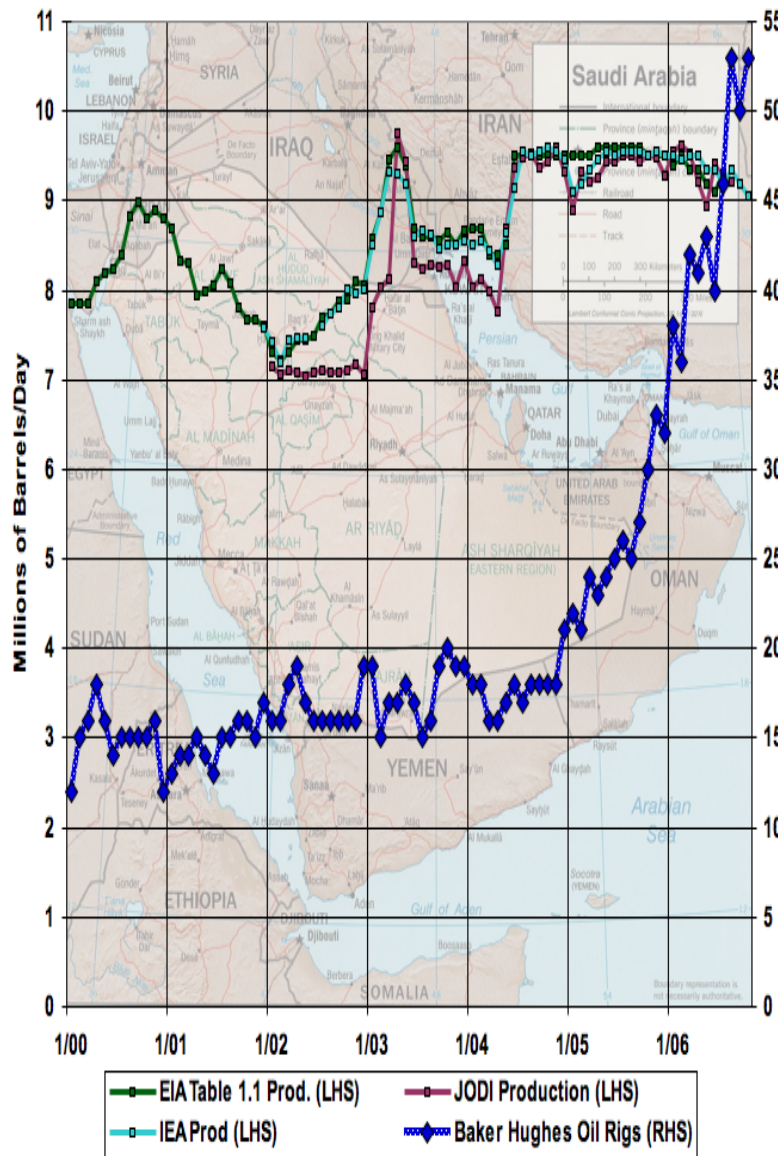
Dr. Sadad Ali-Husseini, former Executive Vice President of Aramco), 2004.

**“OPEC oil reserves are overstated by more than one-third....we have already reached maximum sustainable production. ”**

Dr. Al-Husseini, 2009.



# Turn out the lights, the party's over?



**"Saudis Put Oil Capacity Rise On Hold."**

*Financial Times April 21, 2008.*

**"Saudis Face Hurdle In New Oil Drilling."**

*New York Times, April 22, 2008.*

**"I told them that I have ordered a halt to all oil explorations so part of this wealth is left for our sons and successors God willing."**

**Saudi King Abdullah, Zawya Dow Jones, July 4, 2010.**

**"Without reducing the rate of energy consumption growth, the kingdom could see oil available for export drop some 3 mbpd to less than 7 mbpd in 2028."**

**Khalid al-Falih, CEO Saudi Aramco, Reuters, Feb 12, 2011.**

# Egypt – Canary in the coal mind.

**Egyptian oil production peaked in 1995.**

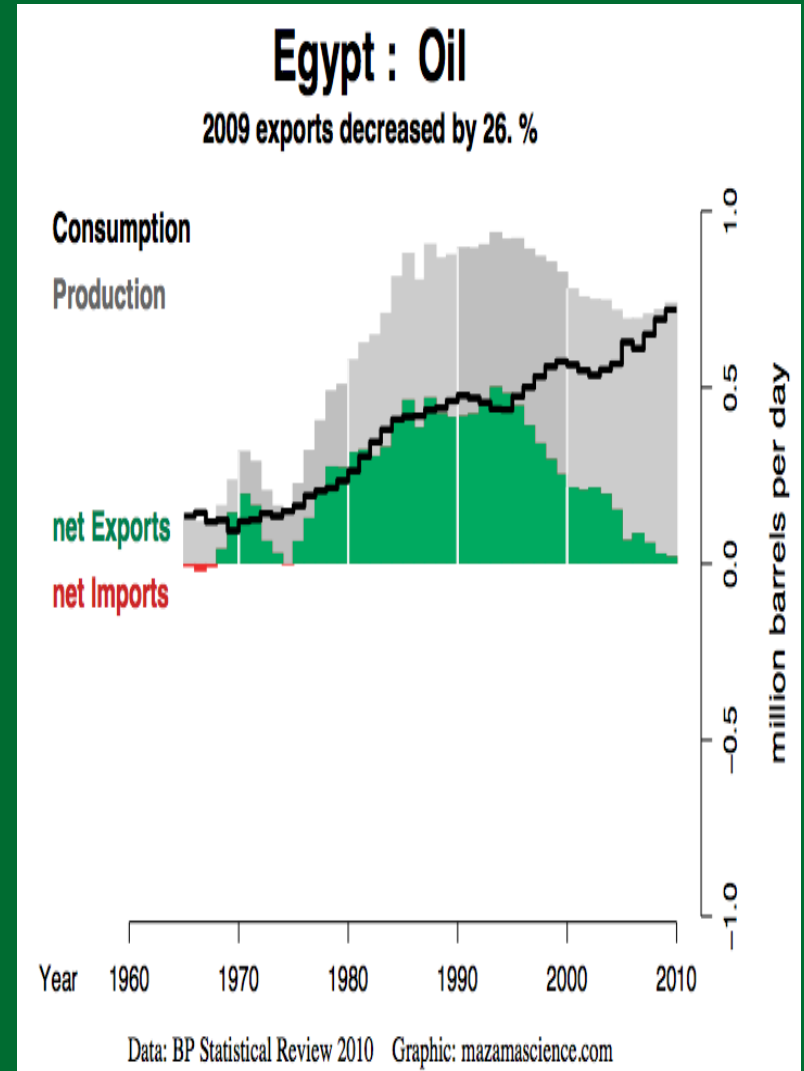
**Production declined at an average rate of 1.6% for 14 years.**

**Internal consumption increased at an average rate of 3% for 14 years.**

**Production declines plus consumption increases resulted in a 95% decline in net exports.**

**Thirty-three (33) net oil exporters comprise 99%+ of global net oil exports.**

**The Consumption/Production ratio for global net oil exporters went from 26.1% in 2005 to 29.1% in 2009.**



# World's Hydrocarbon Delivery System - Old and Rusty.

Price crashes in 80's, 90's, 00's and '08.

IEA estimates \$12.4 Trillion investment needed through 2030.

Global exploration and production spending declined 15% in 2009.

The overwhelming amount of oil left is in the hands of state-run oil companies.

During booms, shortages of people, drilling rigs, yard space, equipment, raw materials and transportation.

|                                |                            |
|--------------------------------|----------------------------|
| <b>Drilling Rig Fleet.</b>     | <b>25 Years Old.</b>       |
| <b>Global Pipeline System.</b> | <b>40 - 60 Years Old.</b>  |
| <b>Tank Farms.</b>             | <b>40 – 70 Years Old.</b>  |
| <b>Refineries.</b>             | <b>40 – 100 Years Old.</b> |
| <b>Oil Tankers.</b>            | <b>17 Years Old</b>        |

# **GOM Blowout – Lessons and Fallout.**

**The "easy" oil is gone especially for major western oil companies.**

**At the limits of human capability to keep the oil supply flowing.**

**Moratorium will hasten and worsen the coming oil supply crunch.**

**Shortages vs. coastlands - coastlands win until shortages cause real pain.**

**No deepwater drilling equals more imports.**

# **GOM Blowout – Lessons and Fallout. (cont.)**

**When production does return it will be much more expensive.**

**The world still needs offshore deep-water energy development.**

**Accidents will continue to happen, but GOM spill may improve responses.**

**Beginning of a serious discussion about the end of the oil age?**



# The reasons demand won't slow down.

## Here Lies the Next Great Opportunity

100% millions of urban households

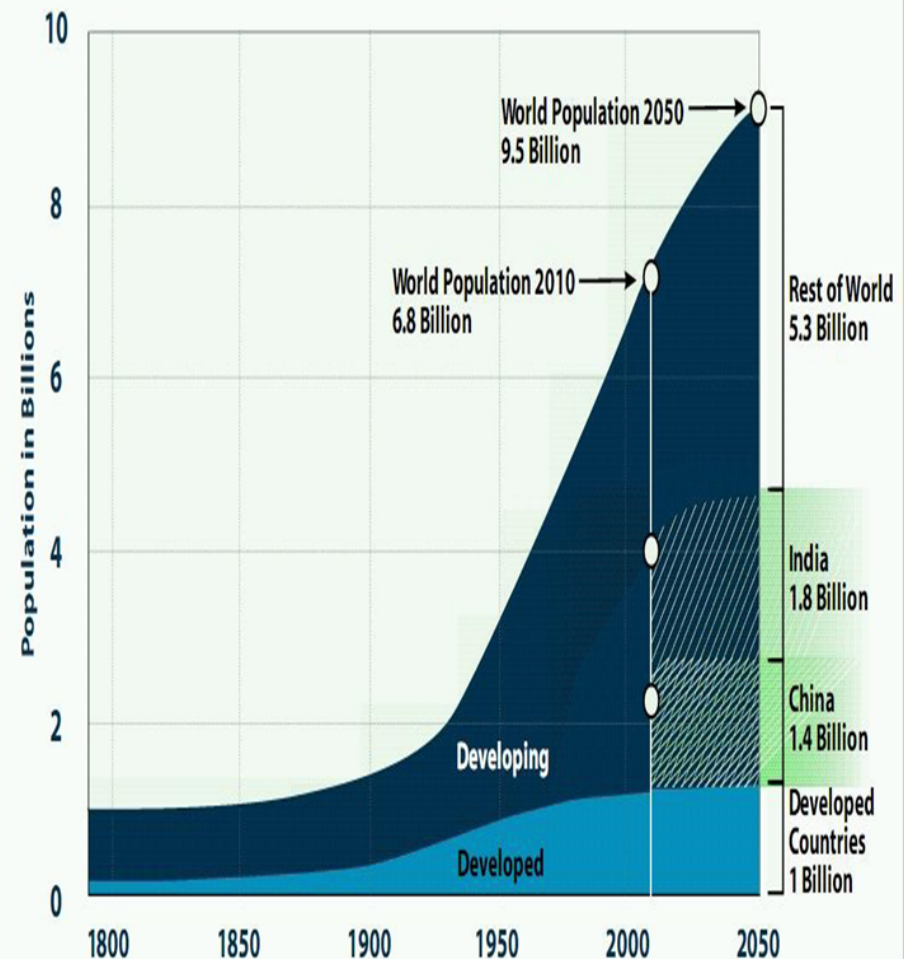
66 100 191 200 373

Segments by annual income

- Global affluent (>200,000 renminbi)
- Mass affluent (100,001–200,000 renminbi)
- Upper middle class (40,001–100,000 renminbi)
- Lower middle class (25,000–40,000 renminbi)
- Poor (≤25,000 renminbi)

1985 1995 2005 2015<sup>2</sup> 2025<sup>2</sup>

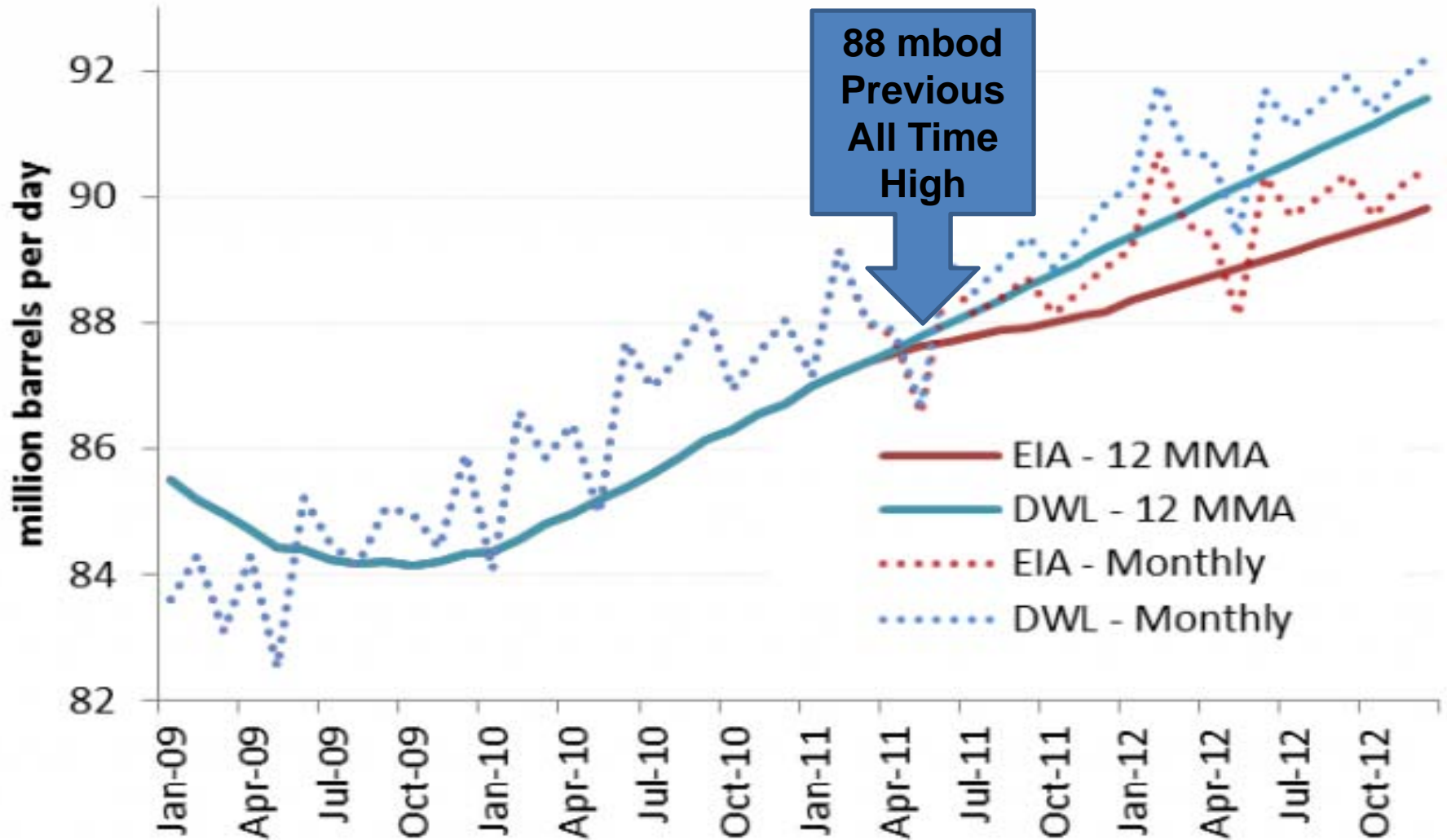
Share of Chinese Urban Households, %



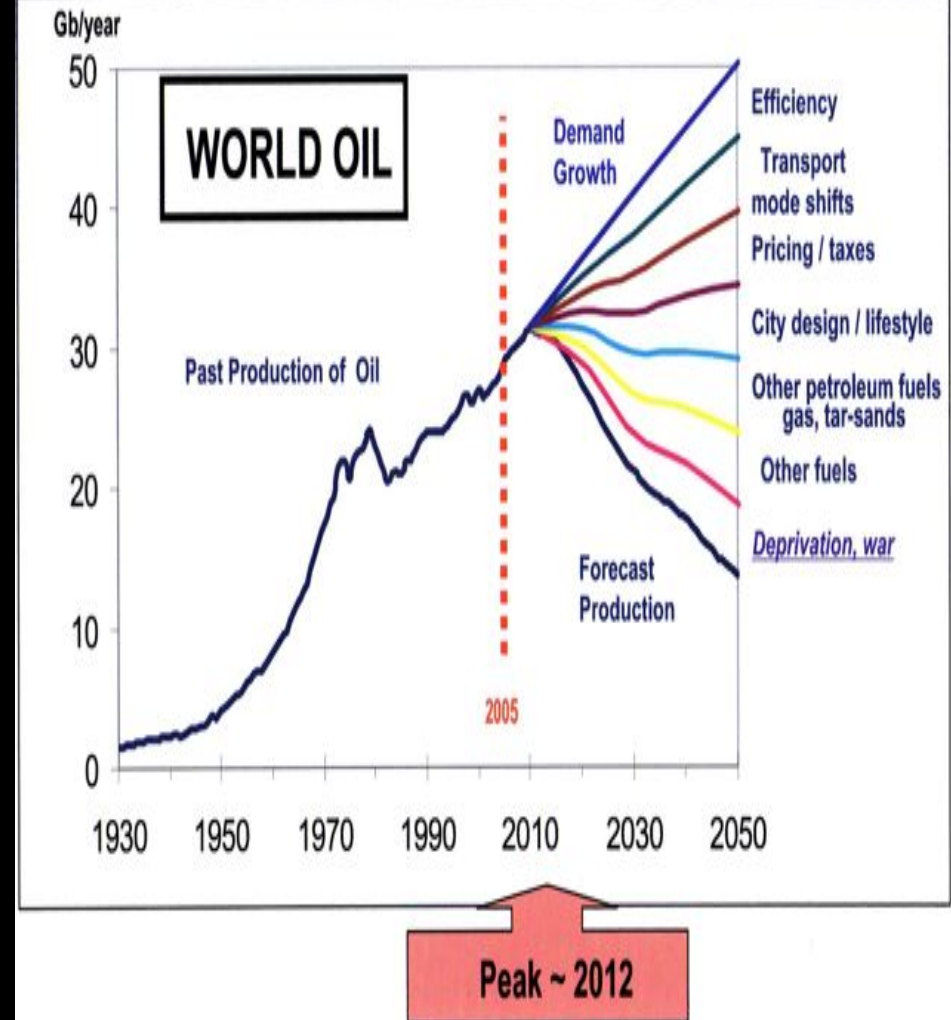
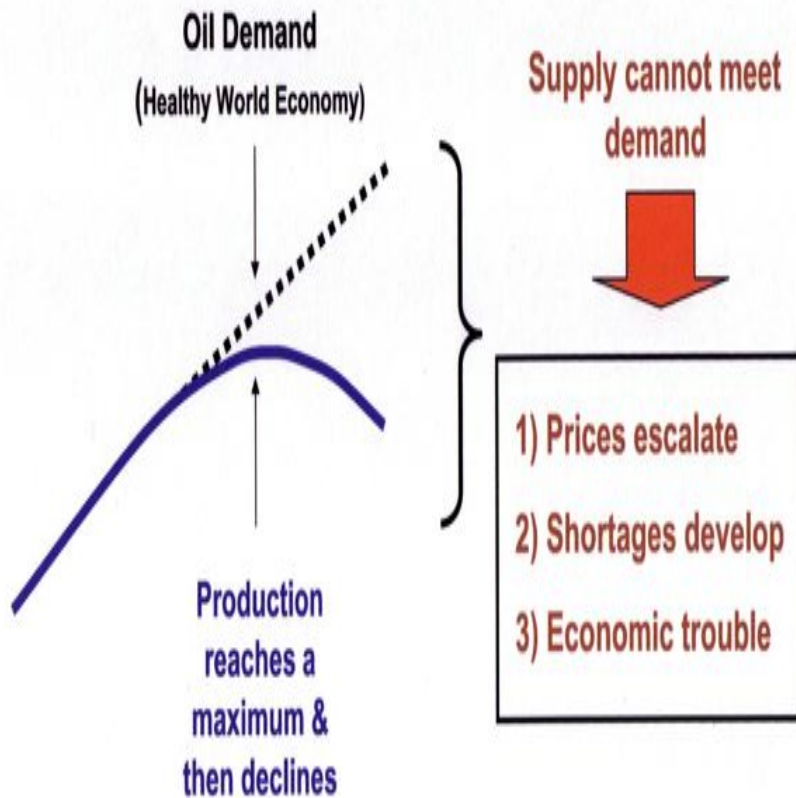
POPULATION TO 2050: DEVELOPED AND DEVELOPING WORLD

SOURCE: United Nations Population Reference Bureau

# Oil Shock Coming Soon?



# No magic bullets – A deep, intractable problem of energy transition.



# **What to expect!**

**Peak oil is here or close enough.**

**Peak oil is a liquid fuels problem.**

**Peak oil could be rapid and severe.**

**Peak oil is not temporary. It will continue until energy bridges are built.**

**Transition will require Brown and Green solutions, time and money.**

**Mitigation of oil shortages will trump other priorities.**

# **What to expect! (cont.)**

**The U.S. will move (slowly but surely) towards modifying our lifestyles to use less energy.**

**Governments will intervene to maintain critical levels of oil supply and protect national security.**

**Expect rationing, demand restraints and non-market based oil pricing.**

**Just-in-time supply chains dependent on worldwide long-distance transportation will be impacted first.**

**We must learn to live with much higher oil prices.  
Adequate supply will be the highest priority.**

# **An urgent need to do reasonable things!**

**Tell the truth.**

**Make efficiency a “real” national priority.**

**Develop a Liquid Fuel Emergency strategy.**

**Increase fuel taxes. Use money to provide tax breaks for efficiency and moving off oil.**

**Speed vehicle fuel efficiency standards.**

**Develop technology to continue offshore drilling.**



# **An urgent need to do reasonable things!**

**Maximize use of alternative fuels (LNG, Hybrid, Electric).**

**Reduce speed limits.**

**Increase truck size and weight limits.**

**Limit operating hours in congested areas.**

**Halt non-essential road and airport construction.**

**Begin a serious effort to replace air, car, and truck transport with rail/water.**

**Remove bio import tariff.**

# **Peak Oil Checklist (Short Version)**

**Does senior management understand that the Petroleum Age is coming to an end?**

**Does the planning process consider Peak Oil?**

**What would be your company's greatest vulnerabilities in a petroleum-/energy-short world?**

**Is there a Liquid Fuel Emergency Plan in place?**

**Are there efforts to monitor and influence public policy?**

**Does the culture reward those who rethink, reduce, recycle, reuse, conserve, and cooperate?**

# **Peak Oil Checklist (Short Version)**

**Is fact-based information available?**

**How is your business impacted at various fuel-price points - \$5, \$6, \$7, \$10 etc. per gallon?**

**Do sales/marketing/manufacturing/supply chain policies fit an energy-constrained world?**

**What can be done to remove complexity from the supply chain?**

**How can the network be made more flexible and changed to eliminate movement and transportation?**

# **Peak Oil Checklist** (Short Version)

**Do sourcing strategies consider Peak Oil?**

**Where are opportunities for on-shoring and in-sourcing?**

**Will your carriers and third parties add value in an energy-constrained future?**

**Can a cheaper mode be used?**

**Where can the system slow down?**

# **Peak Oil Checklist (Short Version)**

**What are the plans to take miles out, improve miles per gallon and take advantage of new fuels and technologies?**

**Is “emergency” transportation really an “emergency”?**

**Do you rely on air freight?**

**How much non value adding “dead air” is shipped (filler materials, packaging layers, shapes and volume)?**

**Are transportation and fuel/energy purchasing centralized?**

# Summary and Conclusions.

**World oil production growth will eventually stop and production will peak.**

**The world has never faced a problem like the decline in world oil production.**

**This is an uncharted, unpredictable bridging period.**

**Government will intervene when crisis hits.**

**Expect confusion/chaos.**



# Summary and Conclusions.

**Begin change today.**

**Take a fresh look.**

**Rethink, reduce, recycle, reuse and reward.**

**Get Lean.**

**Conserve and cooperate.**

**Stay flexible and seriously consider your personal circumstances.**

# Have a safe journey!



**Charles L. (Chuck) Taylor**  
**Head Coach**

**Awake!**

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