# THE PEAK OIL DEBATE
# As The EIA Turns 30

EIA 2008 Energy Conference
Washington, DC
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By:
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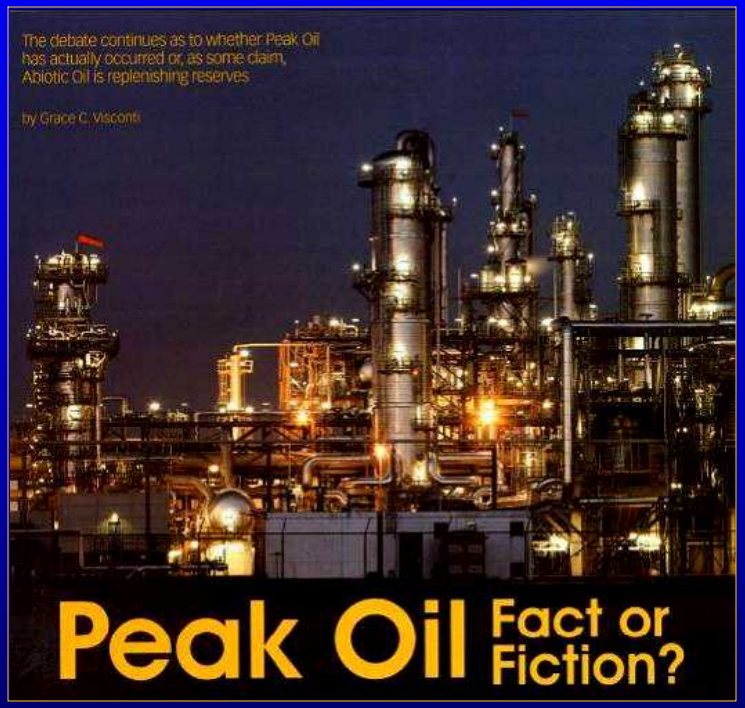
Simmons & Company International

# Should We Debate "Peak Oil"

- Oil seems non-renewable.
- High percentage comes from "mature fields."
- High percentage of new fields are offshore with sharp peaks.
- Oil supply will peak, someday.
- Timing is only debate.




- Fog of non-transparency creates the debate.
- With precise supply data, the debate would end.

# Can The EIA Give The World A 30th Birthday Present?

- Like the IEA, EIA was created to collect timely, accurate energy data.
- Its oil supply model still relies on 3rd party input or guesses.
- The 3rd party models claim solid field-by-field data.
- But, OPEC, Russia and many other producers keep this data as “state or corporate secrets.”

Is it important to have real data?
Can anyone forecast future supply without it?

# Fuzzy Terms Create Great Confusion

- Some fuzzy terms:
  - Decline rates: Does this mean depletion?
  - Depletion: Does this mean oil is gone?
  - Resource endowment: Amount of original oil that might be in place ("OOIP")
  - Recoverable resource: Amount of OOIP that might be recoverable
  - Flow rate: The physical oil volume coming out of a well
  - Peak flow rate: The highest oil volume a well will produce
  - Water cut/gas coning: Why the flows decline (crowding out)

These terms get intermingled too often.

# Conventional Vs. Non-Conventional Oil

- Another confusion is intermingling “conventional” oil with family of “non-conventional oils.”
- Conventional is also not precise term.
- Highest quality conventional is extra light crude flowing at high volumes from pressurized reservoirs.
- Conventional heavy oil: Tar melted into heavy oil by steam.

- Non-conventional oil: All sources worse than heavy oil:
  - Low flows
  - Low quality oil
  - High water content and energy intensive to produce

# Stark Difference Between High Quality Crude And Oil Sands

- Arab Light/Extra Light used to come from North Ghawar, Abqaiq and Berri at 40,000 to 60,000 B/D per well (these high flow rate wells are now depleted).
- Shell Oil's Athabasca Oil Sands Project wants to expand volume of flow by 100,000 B/D (from 155,000 B/D now):
  - Latest cost estimates: $20 billion (est.)
  - Time to create: 5 – 7 years (perhaps)


There is no comparability between high flow light oil and Canadian oil sands, tar is even worse.

# Non-Conventional Issues Worsen When Expanded To Orinoco Oil Belt And Oil Shale

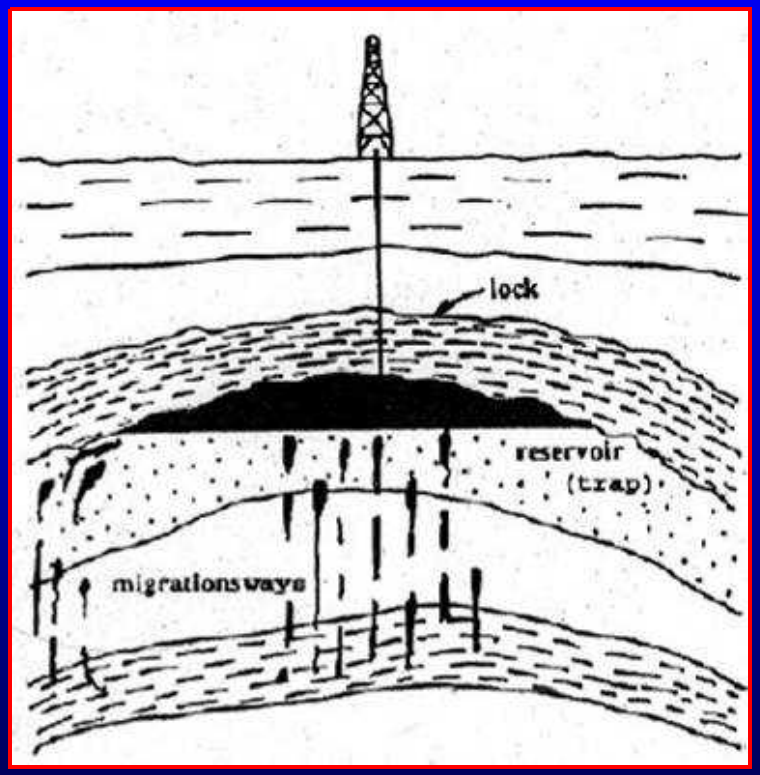
- Estimated volumes of both Orinoco Oil Belt and oil shale are vast.


- No technology has yet created a non-energy intense way to turn either into high flows of usable oil.
- Whether the water usage is worse than energy expended to create energy should be “debated.”

# Beyond Oil Shale Is "Abiotic Oil"

- Over the years, believers in Abiotic Oil arise to refute "Hubbert's Peak."
- Abiotic Oil is being constantly created from migrations of magma gasses.
- Newest Theory:
  - Jupiter's Titan
  - Atlantic Trench

  } Have vast hydrocarbons




- No one, thus far, has figured how to produce Abiotic Oil.

# “Remaining Reserve Estimates” Also Fuzzy

- Remaining proven reserves are non-scientific guesses on remaining OOIP and amount that can be recovered.
- Recent slurry of technical papers question ability to guess these parameters. What is needed:
  - Well-by-well flow rates (not gathered at GOSPs)
  - Water cut by well
  - Numerous well logs throughout heterogeneous fields
  - Core samples throughout any carbonate fields
- Without all four inputs, reservoir simulation models are simply educated guesses without sufficient information.


This is fuzzy logic².

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# Data Scarcity Rampant Throughout Middle East

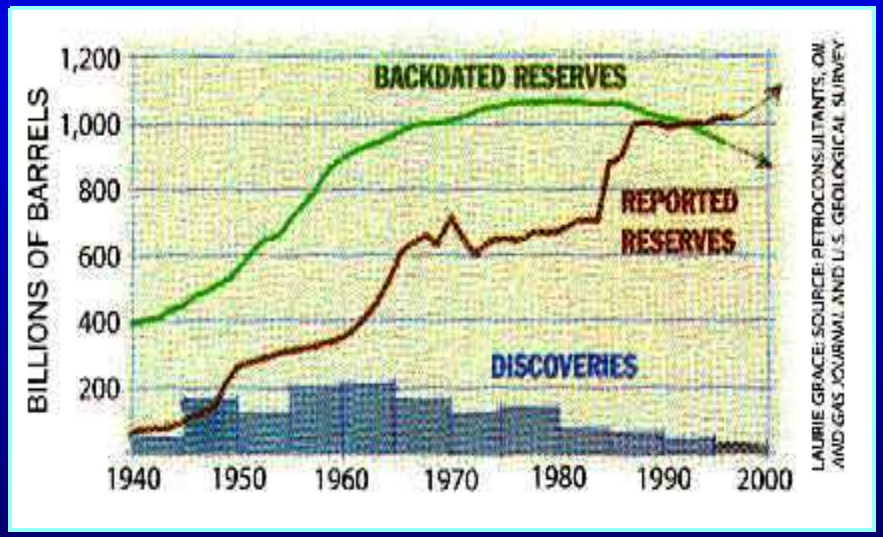
- Only small numbers of super giant Middle East fields have metering at the wells of oil and water:
  - Too many aggregated by GOSP gathering systems
- Small number of cores from producing rocks hinder all future modeling:
  - This complex exercise was too risky and costly when it seemed Middle East Oil was everywhere

# Many Deepwater Fields Face Same Data Problems

- The expense to core and flow test deeper water fields was very high.
- If rocks were also in need of fracturing, costs grew even higher.
- Too many offshore "failures" came through drilling minimal amount of appraisal wells and rarely flow testing for any length or cutting a core sample.

# Paper Barrel Reserves Muddied Proven Reserve Issue

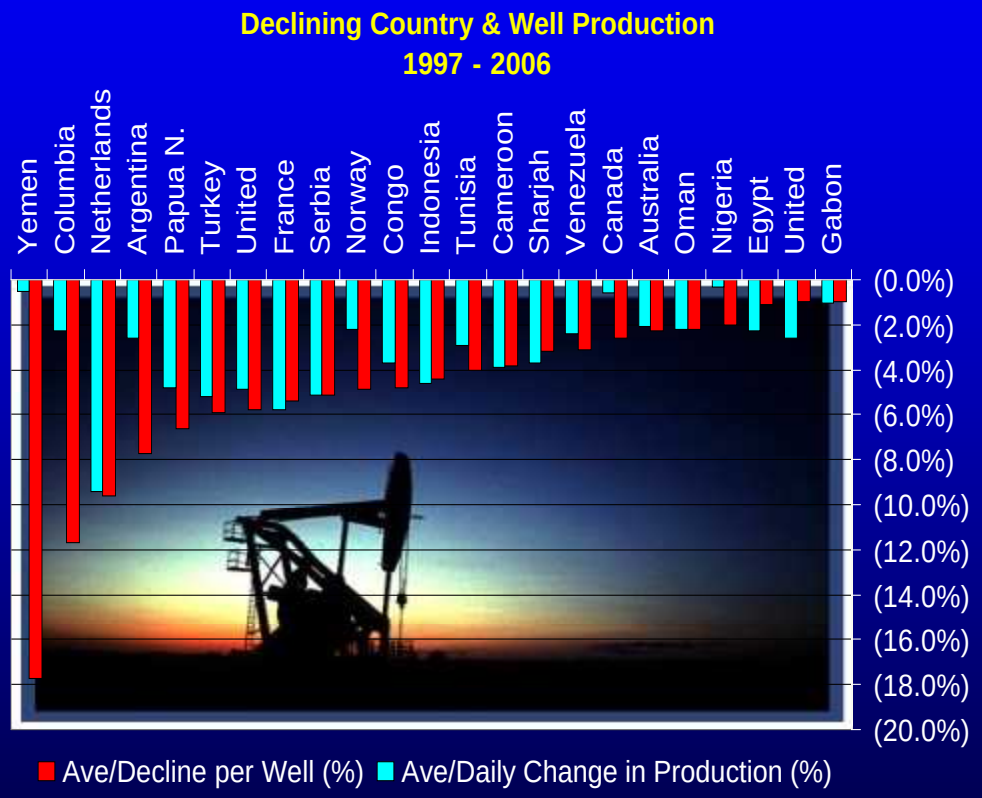
- It is factual that many OPEC producing countries arbitrarily doubled or tripled reported "proven reserves" in 1982 – 1988 era.
- Then, the data stayed stagnant for next two decades.
- This created illusion that the numbers were extremely conservative.




"At least 300 billion of reported global reserves were imagined." - Retired Senior Officer of an NOC

# High Flow Rate Wells Do Decline

- Some drain every layer of reservoir oil ASAP.
- This is necessary to create sufficient IRR.
- But, it led to “monster decline rates”:
  - See pictures of 24 “typical” fields:
    - Real production rates of 20,000 to 100,000 B/D
    - A few super giant fields peak at 1.5 to 2.2 MMB/D
    - A few in between 100,000 B/D and 1.5 MMB/D

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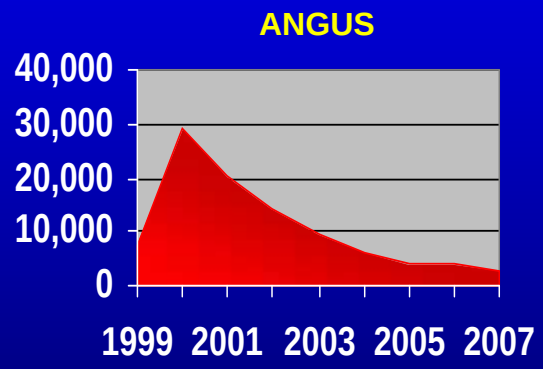
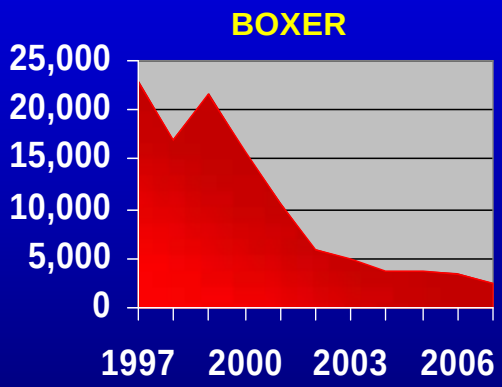
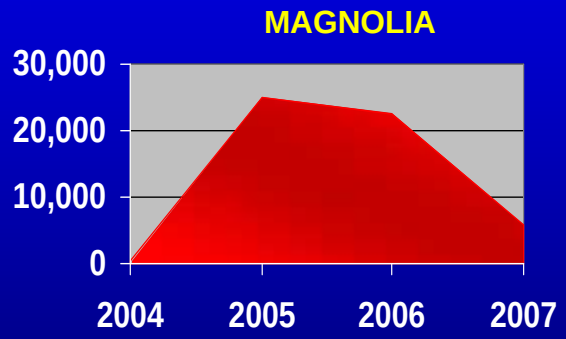
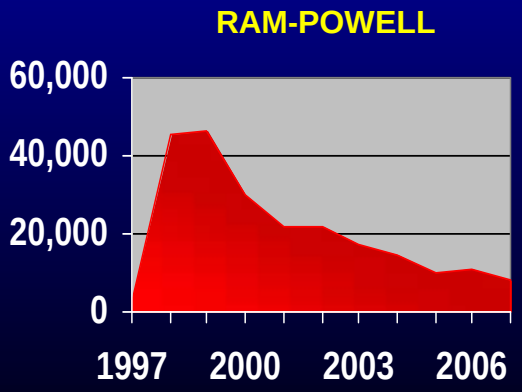
# How Fast Do Oil Fields Decline?
# (GOM Deepwater Field Production – Part I)

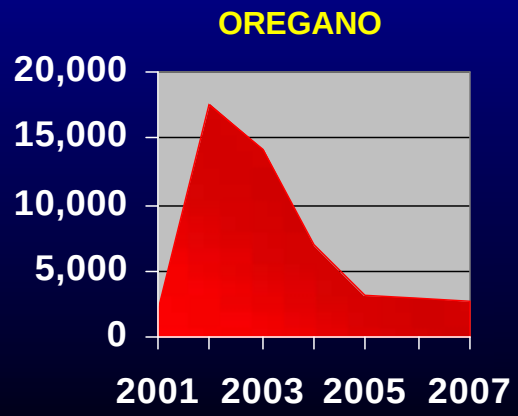
- Vacuum of solid decline data is alarming.
- But digging into data does reveal shocking pictures.
- "A picture is worth a 1,000 words":

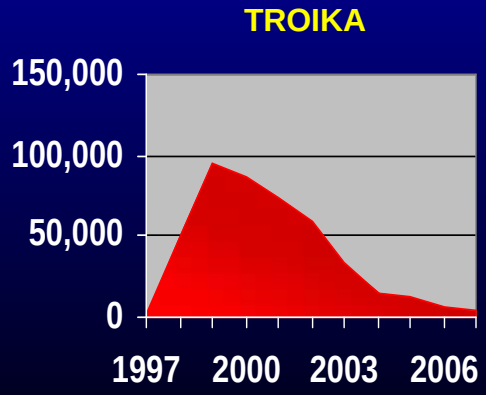


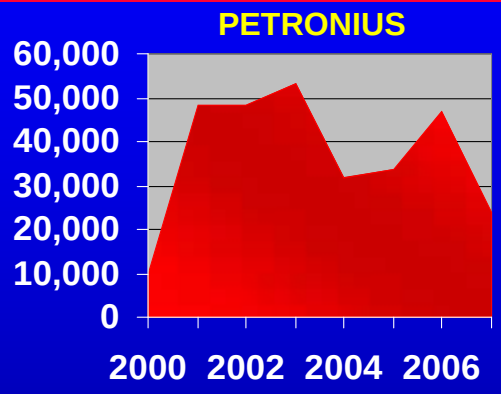



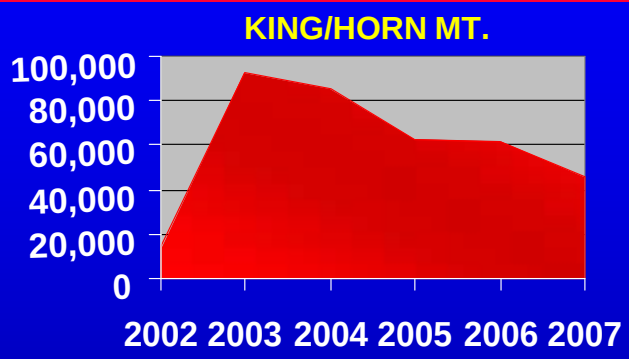



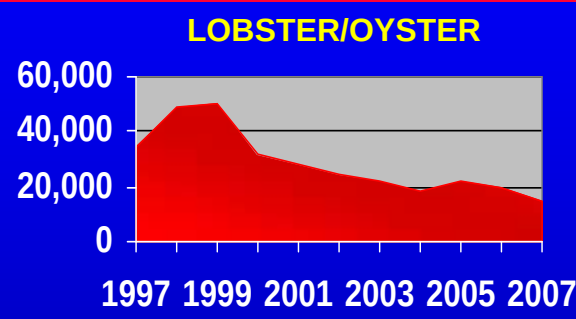



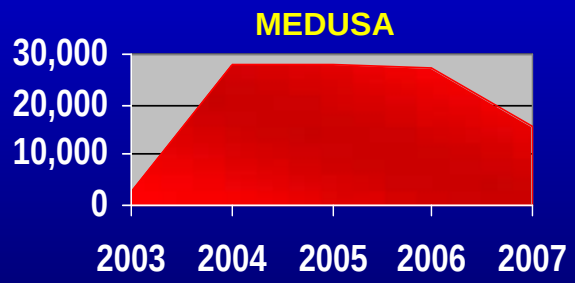

Source: Minerals Management Services

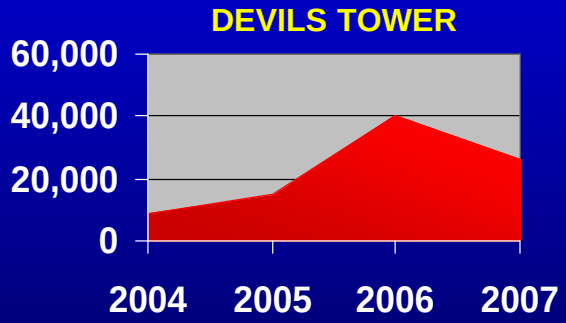
# How Fast Do Oil Fields Decline?
# (GOM Deepwater Field Production – Part II)

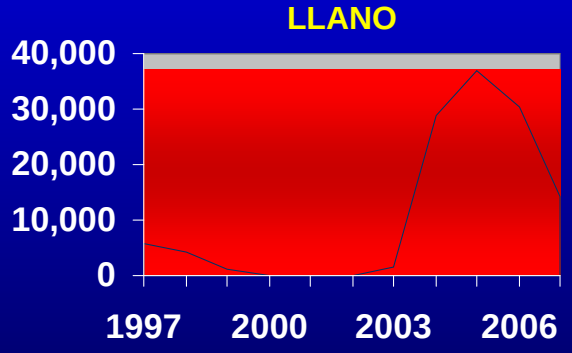


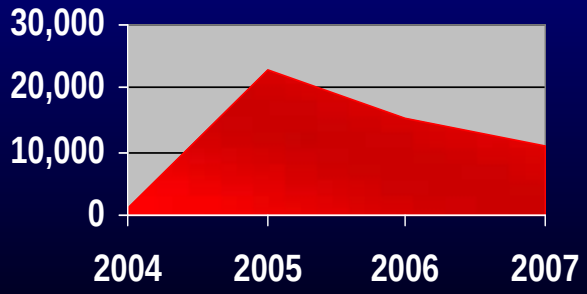



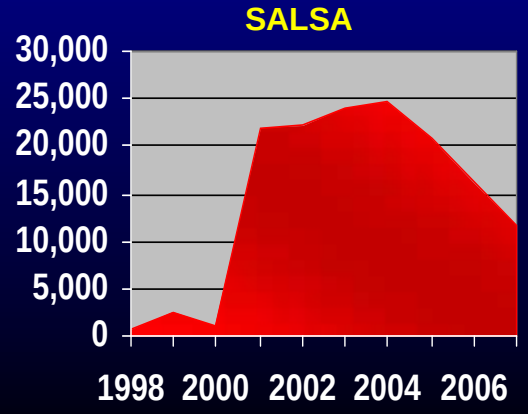



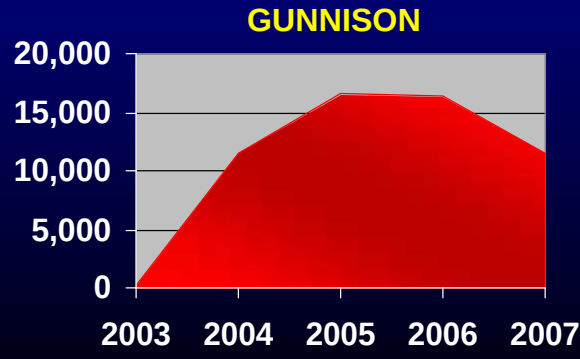



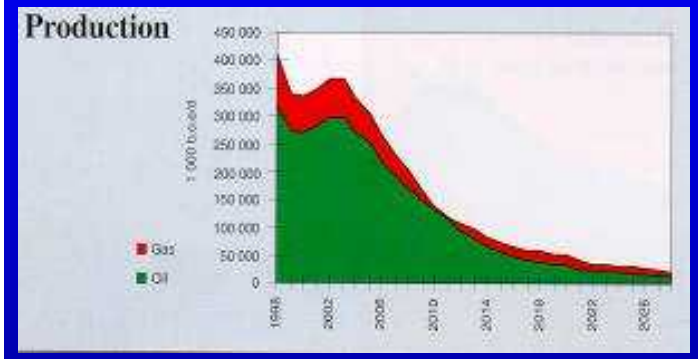



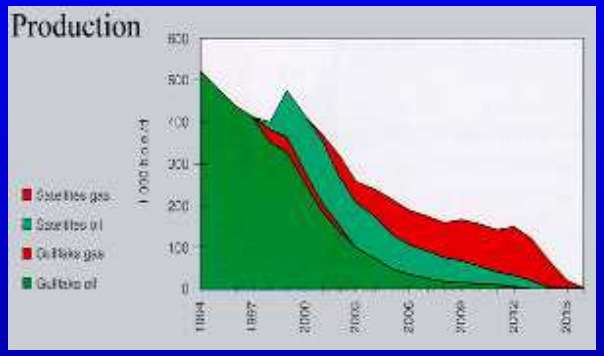

Source: Minerals Management Services

# How Fast Do Oil Fields Decline?
## (North Sea – Part III)

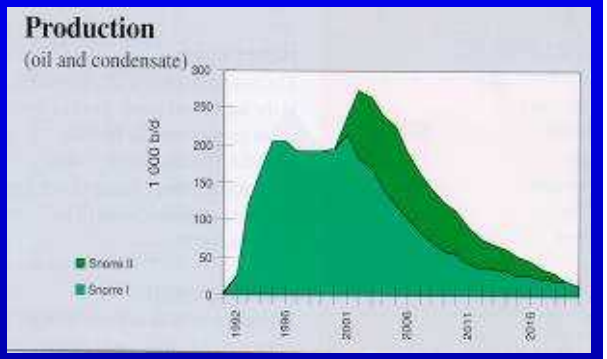
**Ekofisk Area**



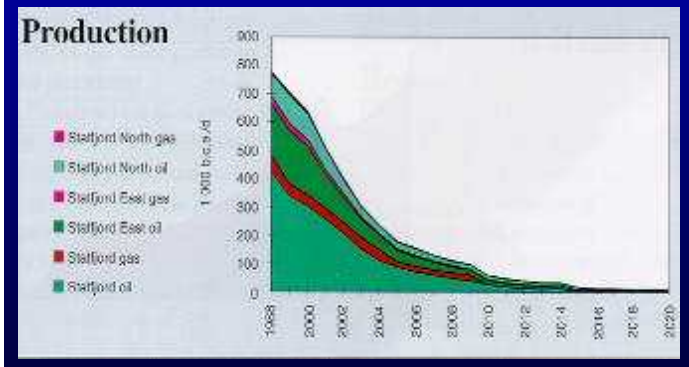

**Gullfaks Satellites**



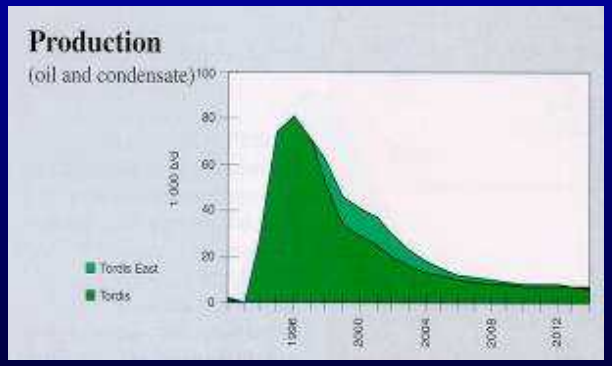

**Snorre B**



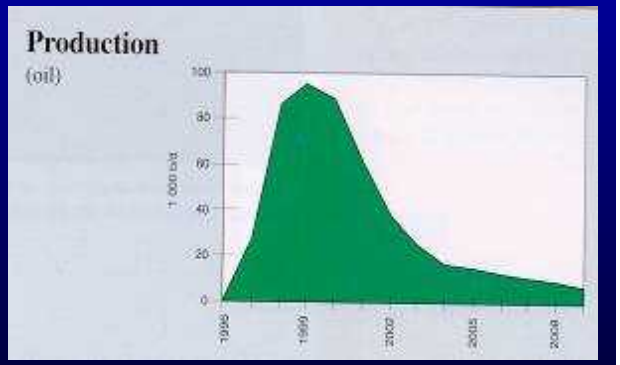

**Statfjord Field**




**Tordis East**




**Vigdis**




Source: Saga Petroleum Report

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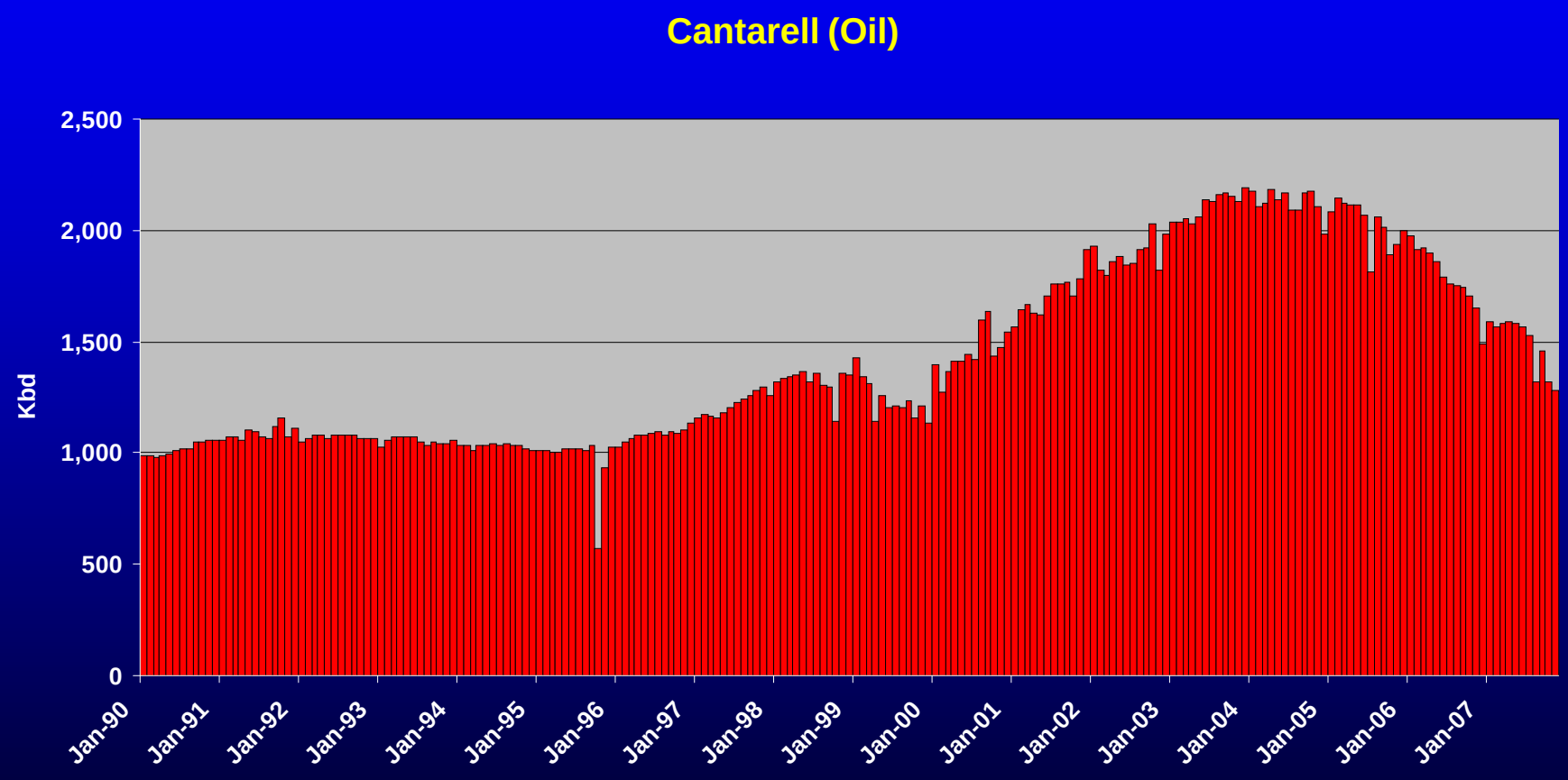
# Cantarell Is A Classic Decline Curve Study




Source: Pemex

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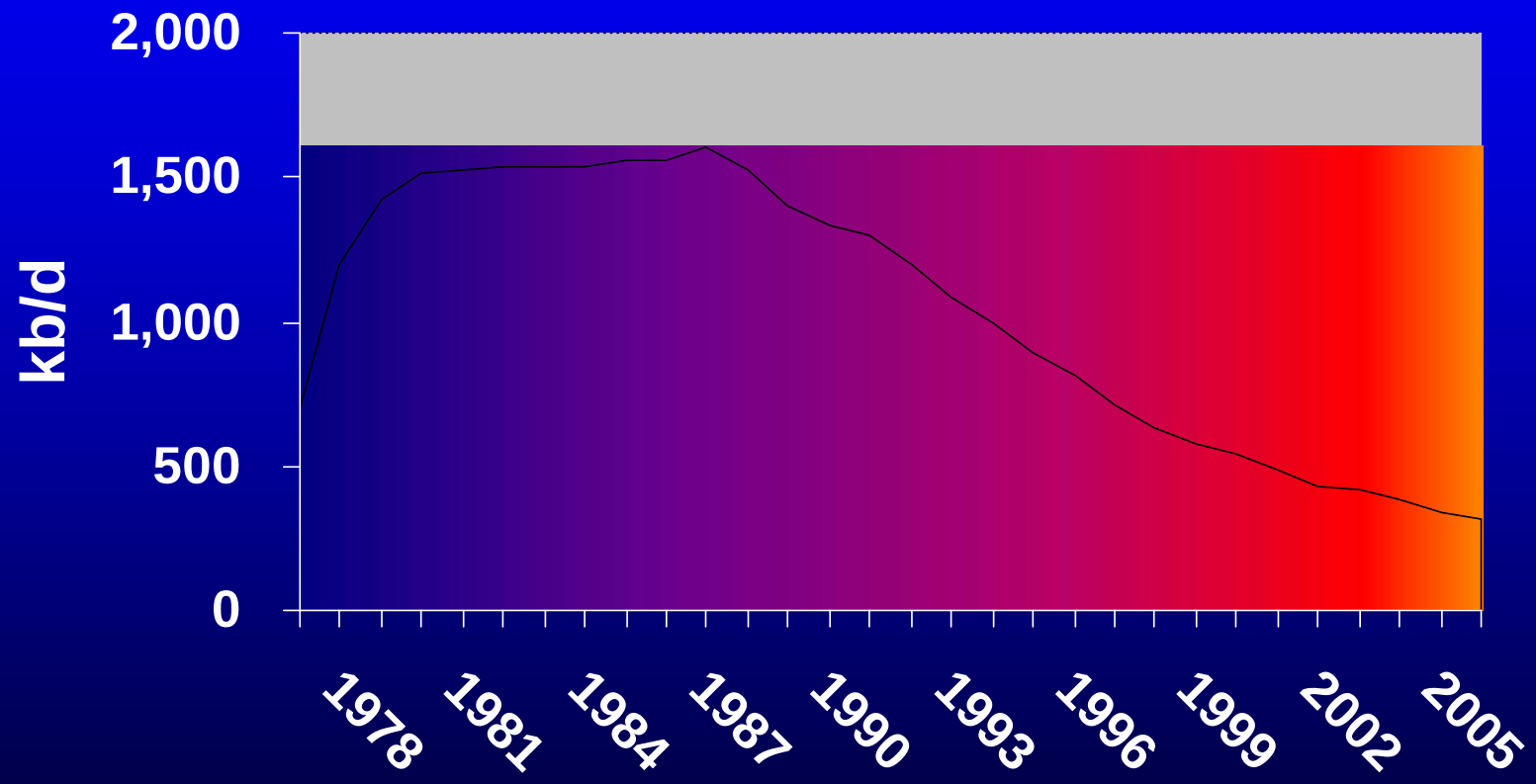
# Prudhoe Bay Decline




Source: Government Sources

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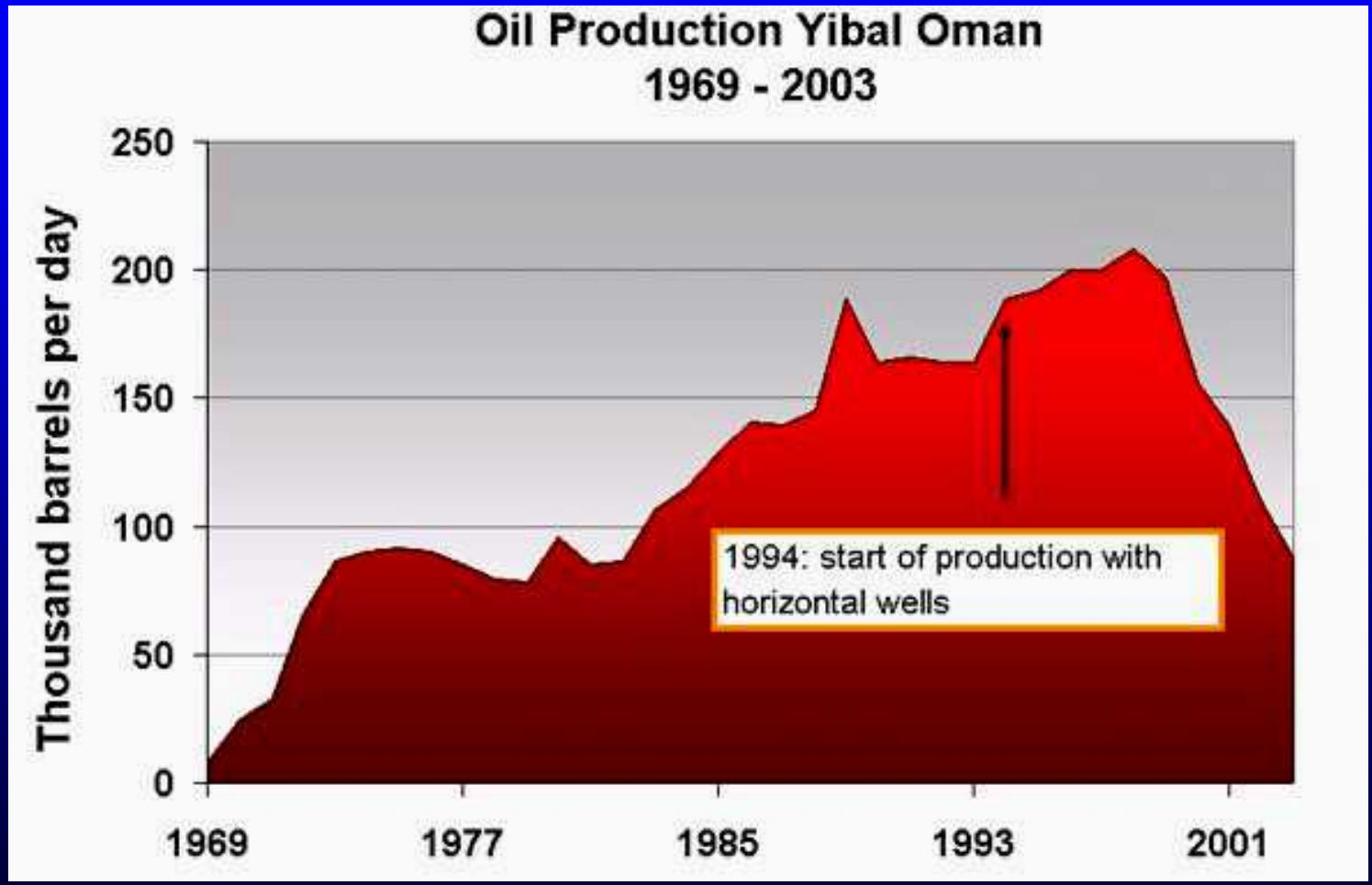
# Yibal, Oman


Oil Production Yibal Oman
1969 - 2003
Thousand barrels per day
250
200
150
100
50
0
1969
1977
1985
1993
2001
1994: start of production with horizontal wells

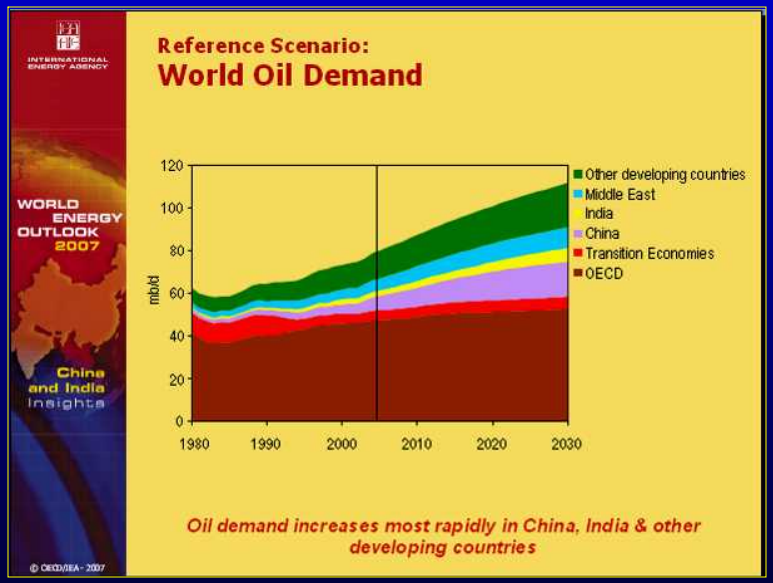
# Is Growing Demand Greatest "Enemy Of Peak Oil?"

- Oil demand was thought to peak in 1988 – 1994 at 66 – 68 MMB/D.
- Instead, it grew to over 88 MMB/D by early 2008.
- This unplanned growth used up 99% of world's spare capacity.
- Demand growth came despite ten fold rise in oil prices.


- China and India are on the march to prosperity.
- Their 2.4 billion people want to drive cars:
  - China is now buying 6 – 8 million vehicles a year
  - India's current rate (average motorbike) is only 1.8 million/year

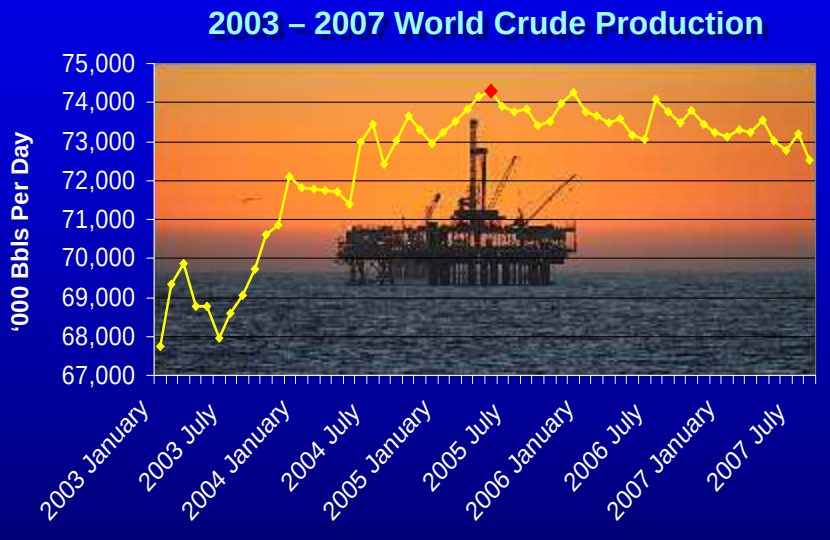
# Oil Demand Headed Towards 100 MMB/D

- Unless global economies collapse, this should be planned to happen (on all current trends).
- Betting on hard landings in India and China a dangerous bet.
- Once 100 million mark is reached, system feeds on itself to further this growth:
  - Prosperity in many resource nations creating fast internal growth
  - $100+ oil is creating prosperity in Middle East



# Global Crude Oil Had Peak In May 2005

- This record (EIA data) 74.3 MMB/D is now almost 3 years old.
- 32 added monthly supply estimates have failed to breach this record.
- Climbing to 75 – 77 MMB/D quickly becoming far-fetched dream.
- The gap to supply 88 MMB/D is spread thin and not sustainable:
  - NGL's
  - Refinery processing gains
  - Sliver of biofuels




Source: EIA Monthly Energy Report

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# Stock Liquidation Is The Last Game Left

- Demand does not slow down when supply slows.
- Draining usable inventories is last great supply frontier.
- We have no gauge when usable “stocks” dwindle from ¼ full to “empty.”
- Empty creates shortage that morphs into a giant “run on the energy bank.”


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# Two Added "Above Ground" Supply Risks Add Urgency To The Crisis

- Rust: Most of the oil and gas infrastructure is built of steel and beyond original design life:
  - High percentage is un-inspectable until leaks happen
  - "Rust" never sleeps
  - We need to rebuild 80% of current infrastructure
- Maturity of workforce: High percentage of global energy work force is too old and retiring:
  - The ex-pats around the world are "coming back home"
  - Talent wars and poaching are getting fierce

Alaskan Pipeline

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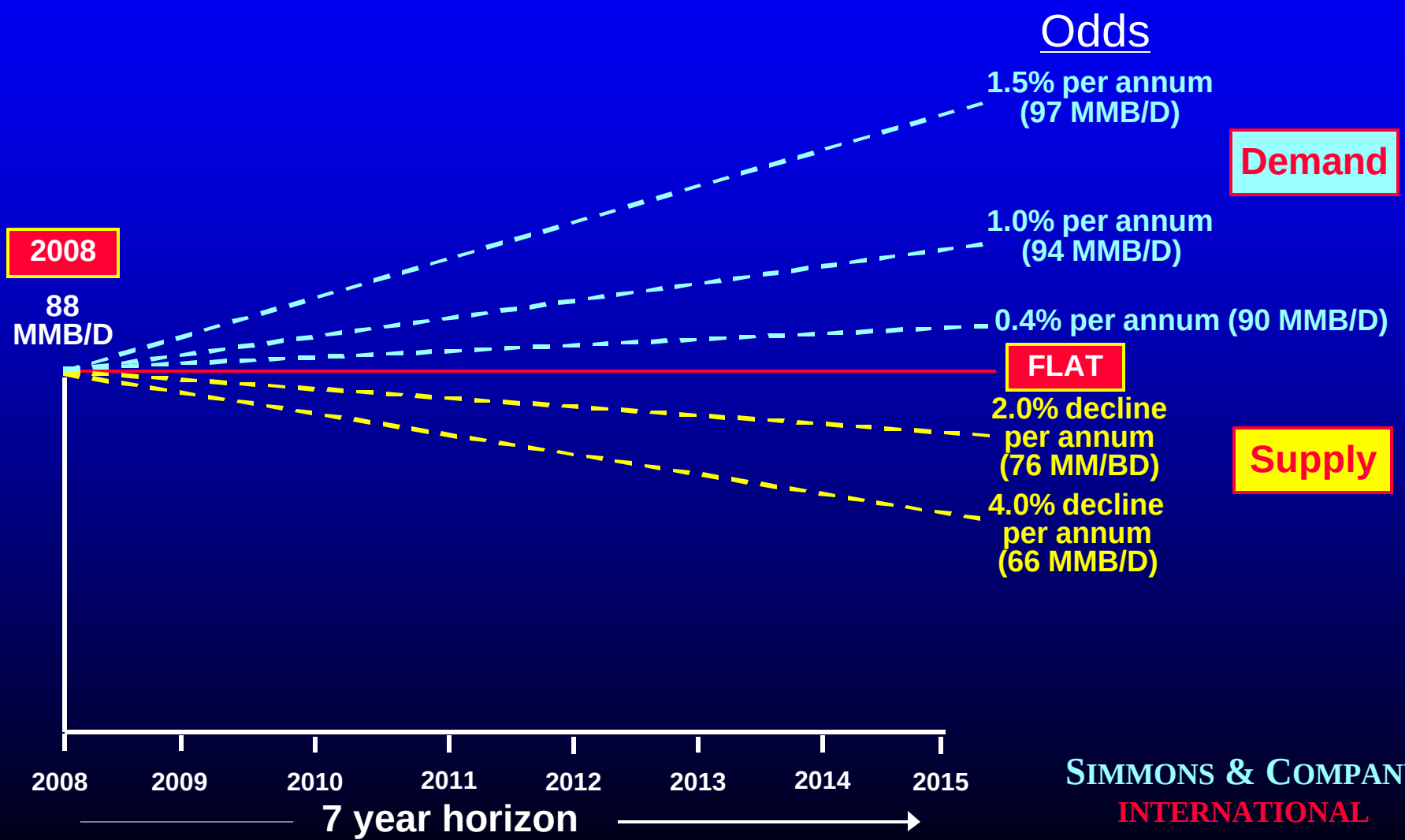
# “For Lack Of A Nail, The War Was Lost”

- Does it matter how the 1871 Great Chicago Fire started? (i.e. whose lantern the cow kicked over)
- Above ground risks will hamper supply but can ultimately be fixed (in decades).
- Below ground risks are the age of reservoirs, declining quality of heavier tainted oil and deteriorating quality of producing reservoir rocks (these cannot be fixed).

# Peak Oil Is Extremely Real And Extremely Risky

- There is nothing fuzzy when oil demand outstrips faltering supply.
- It creates a clash between energy haves and have nots.
- It can lead to social chaos and war.
- Ignoring the risk or hiding behind secret undisclosed supply data could be a colossal mistake.

# The Path Through A Mine Field (Or "Decision Making Under Uncertainty")

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# Summation Of Odds

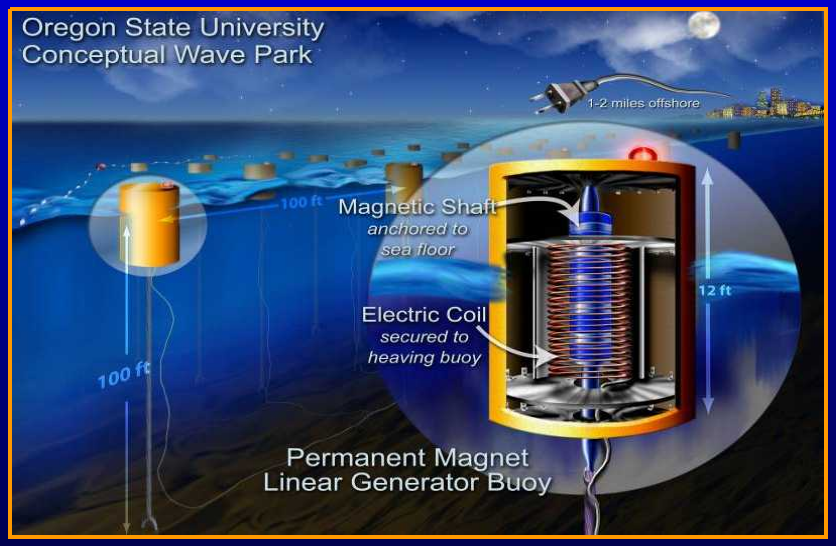
- Flat demand and flat supply = “best case?”
- 1% demand growth + 2% production decline = “most likely?”
- 1.5% demand growth + 4% decline = “shortages ahead?”
- None represent “worst case.”

THIS ISSUE IS THE MOST SERIOUS RISK TO SUSTAINING THE 21ST CENTURY.

# Benefit of Ocean Energy: Proximity To Demand

- Energy production needs to be close to where energy is used.
- In USA, 54% of population and homes are located in counties on our coasts:

| Coastal Counties | People (millions) |
|---|---|
| Atlanta | 69 |
| Gulf of Mexico | 20 |
| Great Lakes | 28 |
| Pacific | 40 |
| | 157 |




- Around the rest of the world has the same demographics.

# History's Great Lessons

It is said that there are only three great lessons to be learned from history

- "Who the Gods wish to destroy, they first make mad."

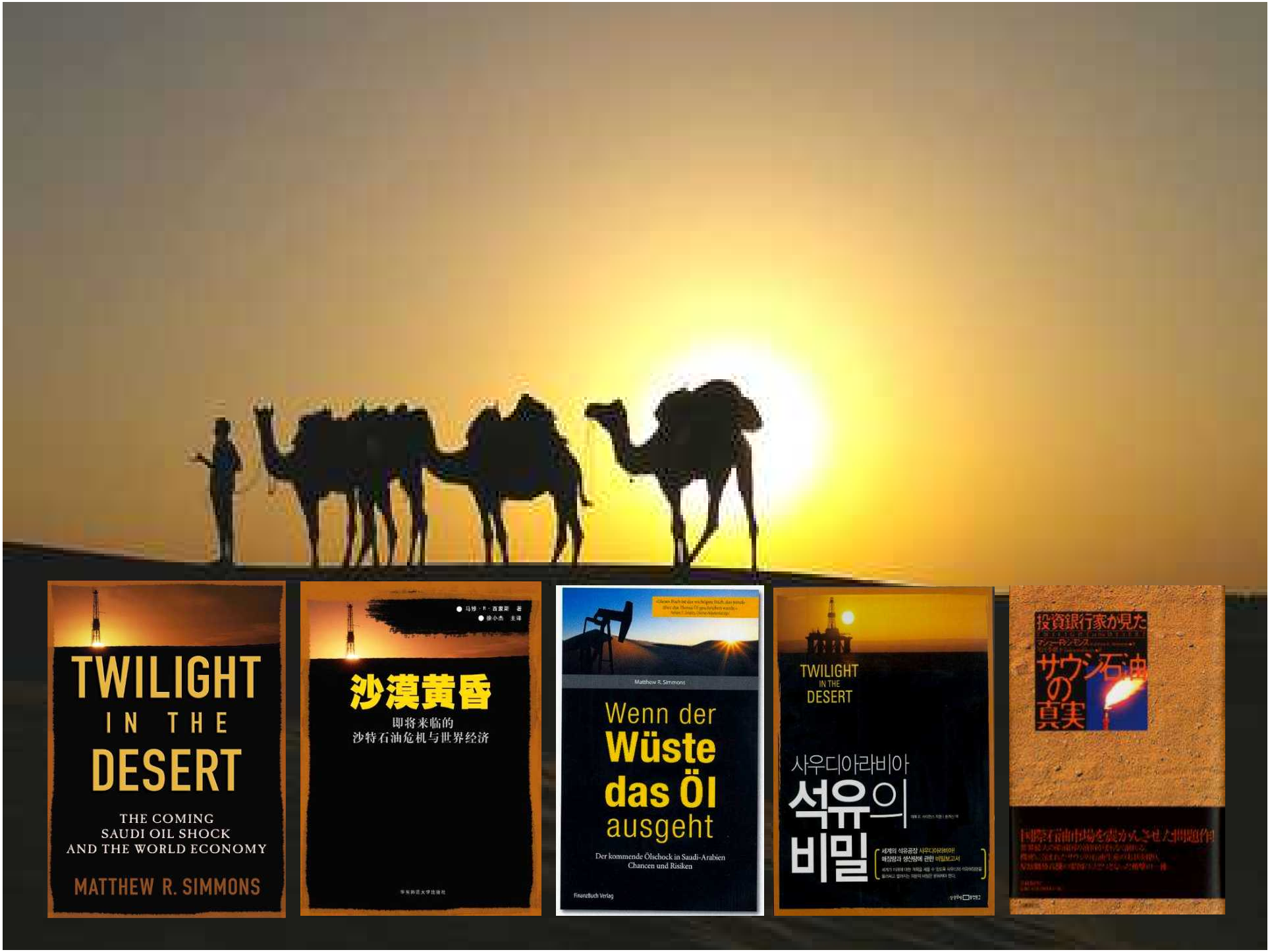
  *Euripides (Greek Philosopher (406-480 BC)*

- "Though the mills of God grind slowly, yet they grind exceedingly small."

  *Sextus Empiricus (ancient Greek Philosopher)*

- "History repeats itself. That's one of the things wrong with history."

  *Clarence Darrow (US defense lawyer (1857-1938)*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THE COMING
SAUDI OIL SHOCK
AND THE WORLD ECONOMY
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