

Why won't they listen to us?

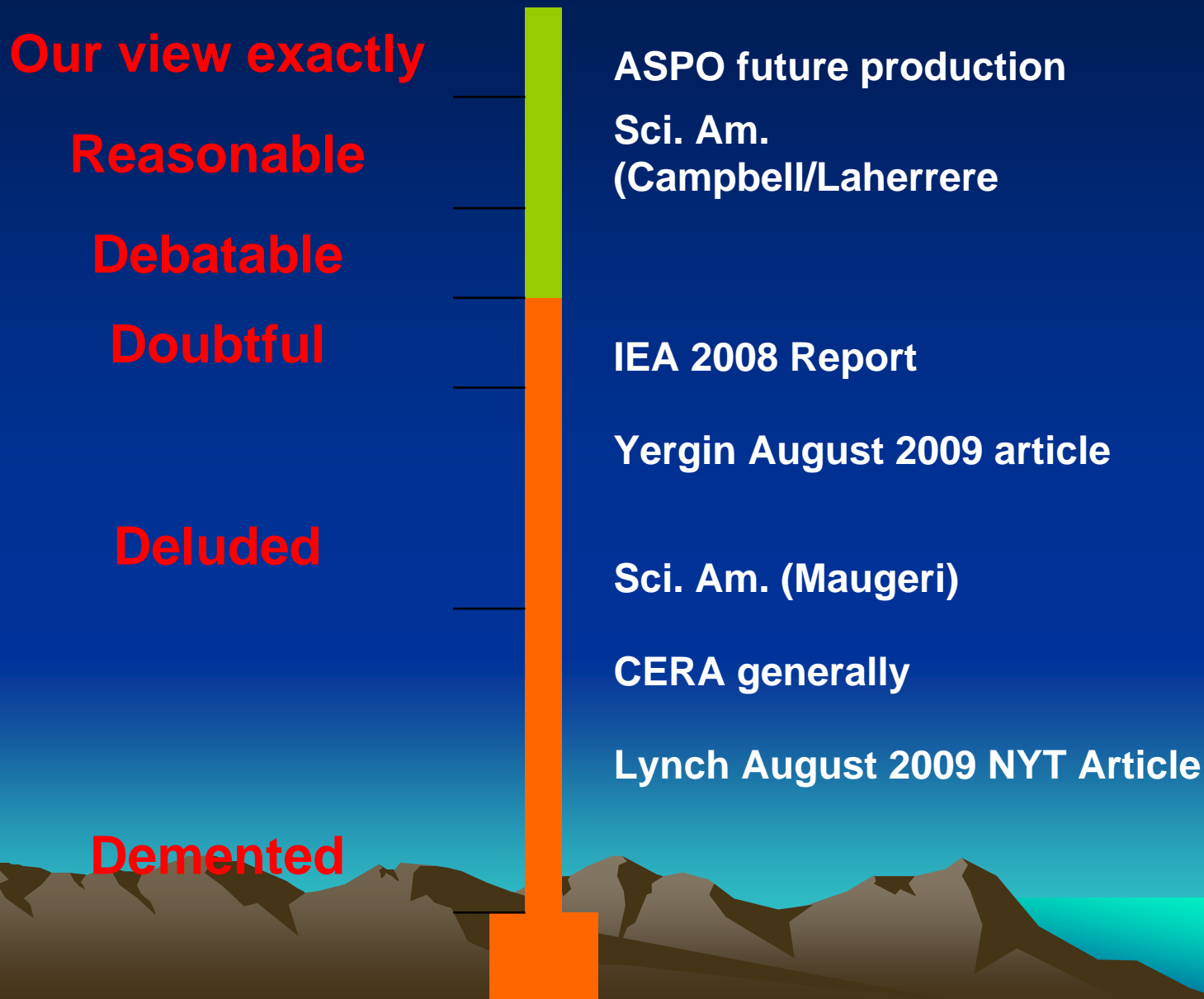
- and should we sometimes listen to them?

Jerry Gilbert

Barrelmore Ltd.



The ASPO-opiniometer



ASPO Self Assessment

Our own statements aren't perfect:

Responses often abusive

Lack technical understanding

'Water cut' significance

'Irreversible Declines'

'Fuzzy Logic'

'Running out of oil'



Key words in reserve/supply estimating:



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UNCERTAINTY

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How confident should we be in THEIR Supply Estimates?

Individual IOCs/NOCs/agencies have:

detailed data on individual fields

sophisticated numerical simulators

**but no single group has access to global set
of results or can exert impartial Quality
Control**



How confident should we be in ASPO's Supply Estimates?

Limited reserve data - but on all world producing areas

**Potential for 'Decline Curve Analysis' and
'Creaming Curve' Analysis**

'Megaproject' data for short-term predictions

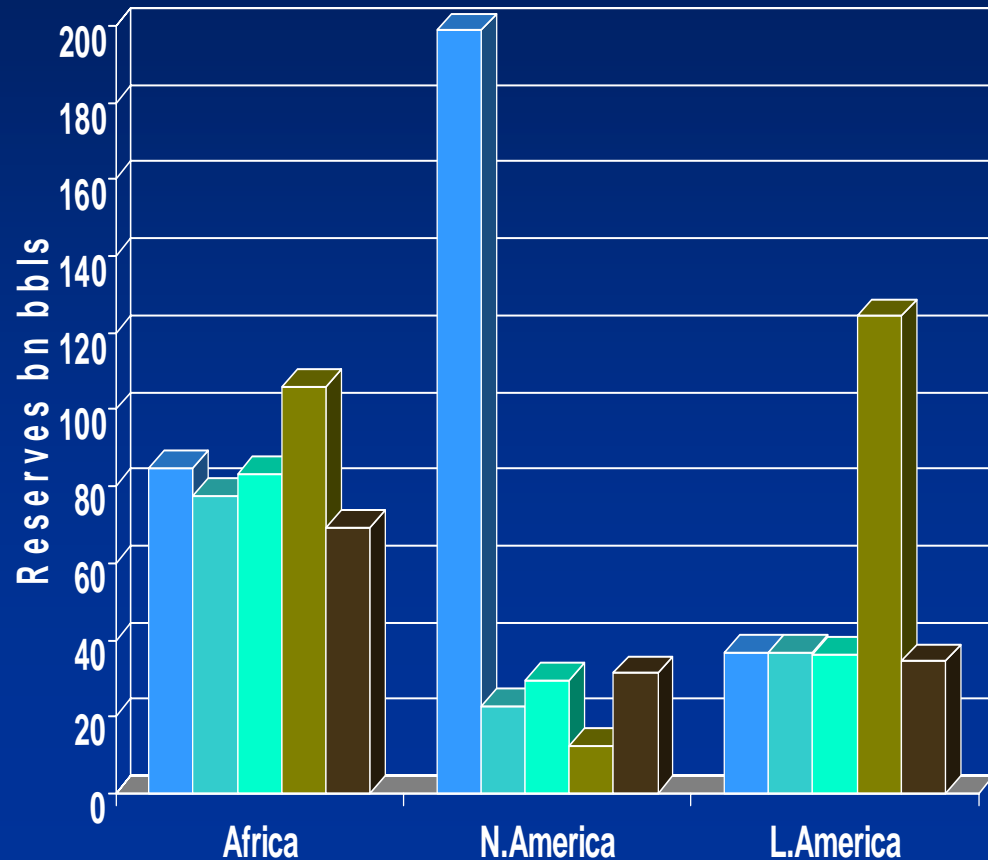
Unbiased expert checking



Overall: A crazy situation

No-one has data or resources to make detailed analyses for world production

Publicly available data is sparse and of poor quality



Twisty Path to the Truth

ASPO's early predictions were pessimistic, with peaks in 1990s or early 2000s, and shown to be so – much to delight of the Odells and Lynchs!

Problems dealing with Reserves Growth and Remaining Reserves, arising from US SEC's antiquated procedures, now mostly resolved

But ASPO's post-peak behaviour estimates have not changed



Basis for ASPO Supply Calculations

Model	Data Set	Application Period
Campbell's Worldwide	Creaming curves Decline Curve analysis Industry informants	Short/Medium/Long
MegaProject Worldwide	Published data Industry informants	Short/(Medium)

Basis for Industry Supply Calculations

Model	Data Set	Application Period	Confidence Level
Decline Curves	Individual field performance	Short	Good, late in field life
Numerical Simulation	Detailed field rock and fluid properties/ distribution, performance history	Short/ Medium/ Long	Very high, if long performance history

Us v. Them

ASPO	Reserve and depletion data by country	Calculate rates by country	Sum to get world supply
	DATA SPARSE AND UNCERTAIN	SUBJECTIVE - CONSERVATIVE?	THE BEST THERE IS!
Industry	Calculate rates by field	Sum field profiles to get rates by country	Sum to get world supply
		DATA VERY SPARSE AND UNCERTAIN	MOST ESTIMATES BIASED OR INCOMPLETE

Getting to the truth!

Technically best-possible forecast only possible if some agency has access to detailed descriptive and performance data for world's largest fields

Modest start underway?:

UN Joint Oil Data Initiative

IEA's 2008 study

Price-based reserve standard

(Al-Husseini, JPT August)



THEIR criticism of OUR estimates

Exploration Success

Assumptions are for very much lower level than, e.g., USGS

Recovery factors

Historically based and don't allow for hoped-for technological breakthrough

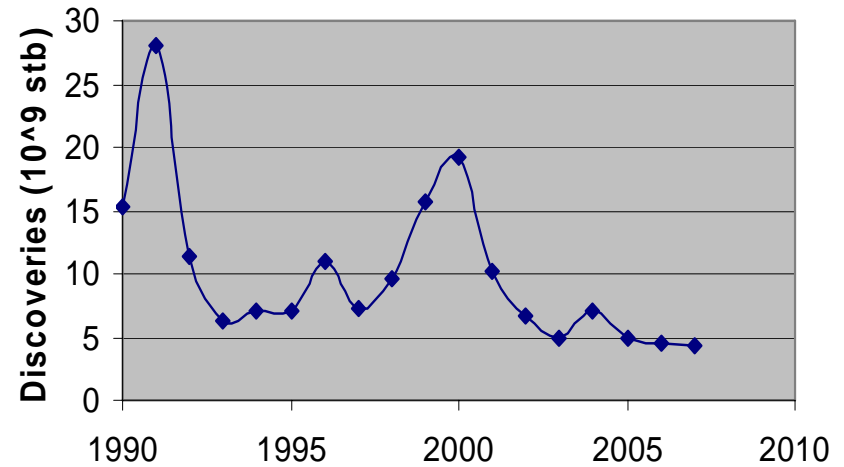


Exploration Success

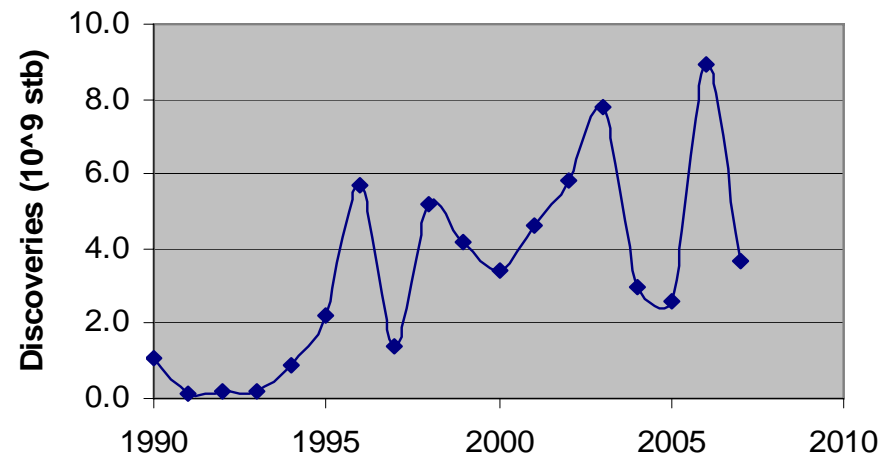
No revision in
'Regular Oil' YTF
justified

'Deep Water' YTF
may be a little
low – but little
impact on supply

Regular Oil Discoveries



Deep Water Oil Discoveries



Future Impact of New Technology

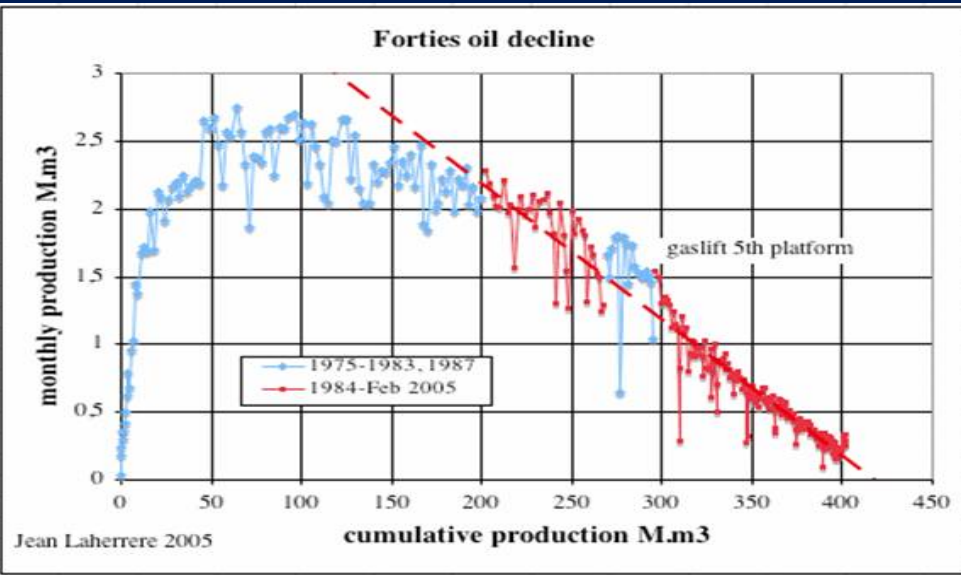
Main difference between THEM and US

THEM: New technology will bring large increases in Recovery Efficiency, and hence in reserves, and allow higher production rates

US: Technology hasn't had much impact over last few decades, so why should it in the future - in even more challenging conditions?



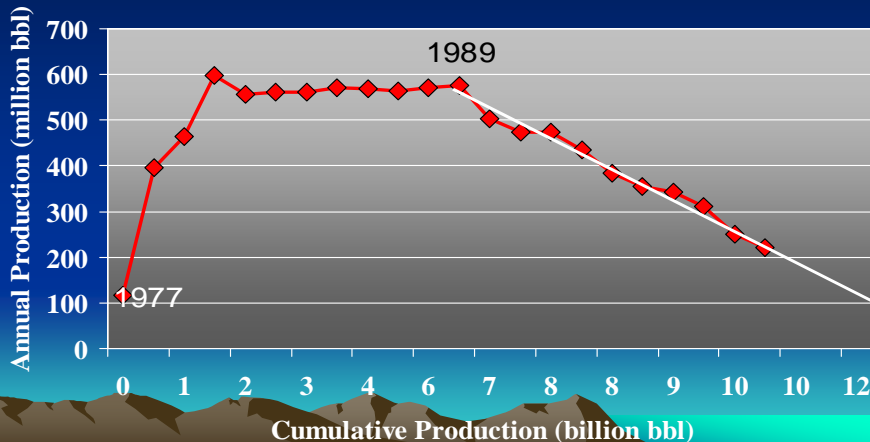
Recovery Factor Improvements ?



Between late 1970s and early 2000s no clear increasing trend in Recovery Factors despite technology application

Prudhoe Bay

1977 Internal Estimate : 12.5 -15 Gb
Initial Report to SEC : 9 Gb



Recovery Efficiency and Oil Price

Theoretical recovery efficiency set by rock/fluid properties and physics

Actual recovery efficiency always less than theoretical value but higher prices may permit greater investment in technologies which improve recovery



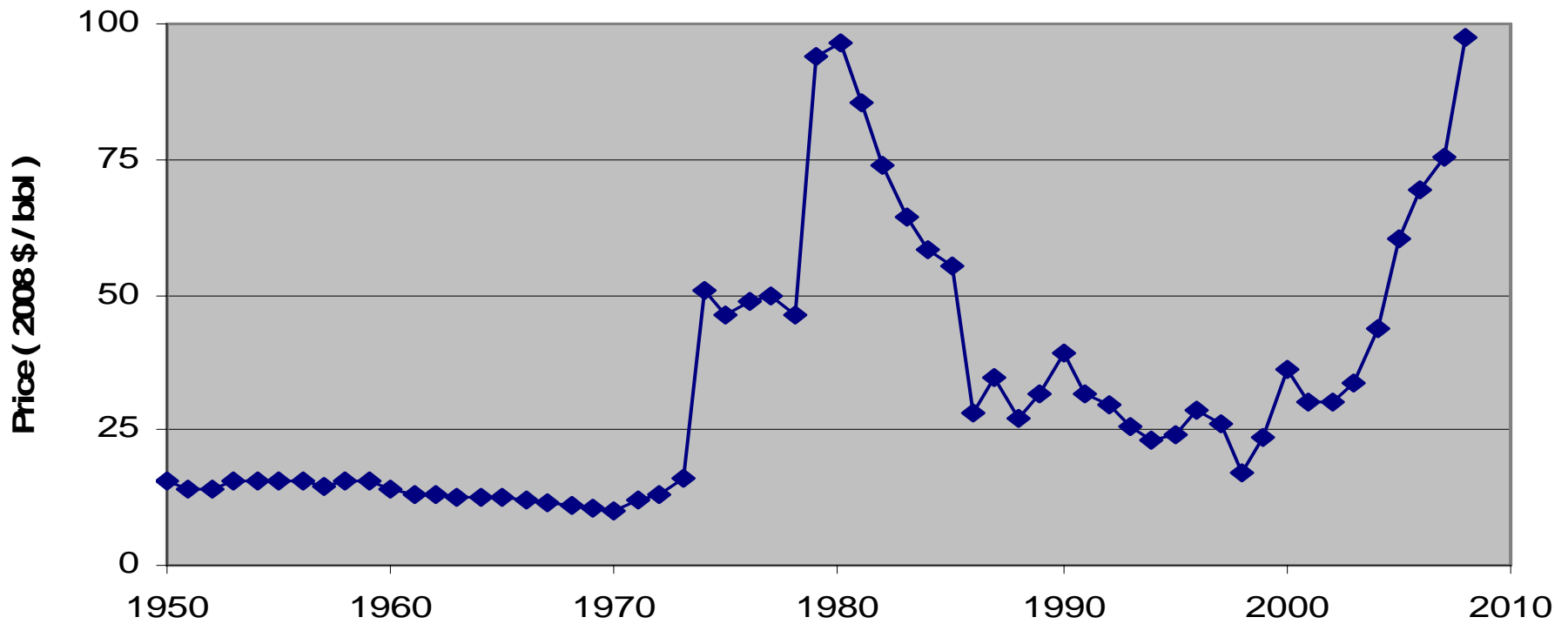
Evolution and New Technology

Clear parallels with natural selection, in particular with 'punctuated equilibrium'!

Technology development not smooth but periods when little innovation occurs are followed by other periods of radical advance



'Real Oil Price' and 'R. and D.'



**R. and D.
Leaders :**

IOCs

X

**Service
cos.**

**...
and
NOCs**

Second Thoughts

Fields developed in 1980s to early 2000s used technology from prior to mid-1980s - some improvements/modifications but no breakthroughs

- 3D seismic**
- Directional and CT drilling, multilaterals**
- Massive hydraulic fracturing**
- Submersible pumps**
- Polymer and surfactant flooding**
- Application of high-speed computing for simulation and development optimization**

REAL 'ReservesGrowth' !!

Lack of investment in technological R. and D. during past periods of low profitability means recovery efficiency has increased very slowly

If investment returns, and NOCs start to play a larger role, acceleration in increases in recovery efficiency should occur



Emerging Technologies

Pore-level collection of reservoir data; pore-level (or even molecular level) studies of displacement processes to optimize field development

Quantum leap in waterflood management (with clever polymers to control movement, low salinity fluids to reduce IFT)

Ability to develop ultradeep, HP/HT fields

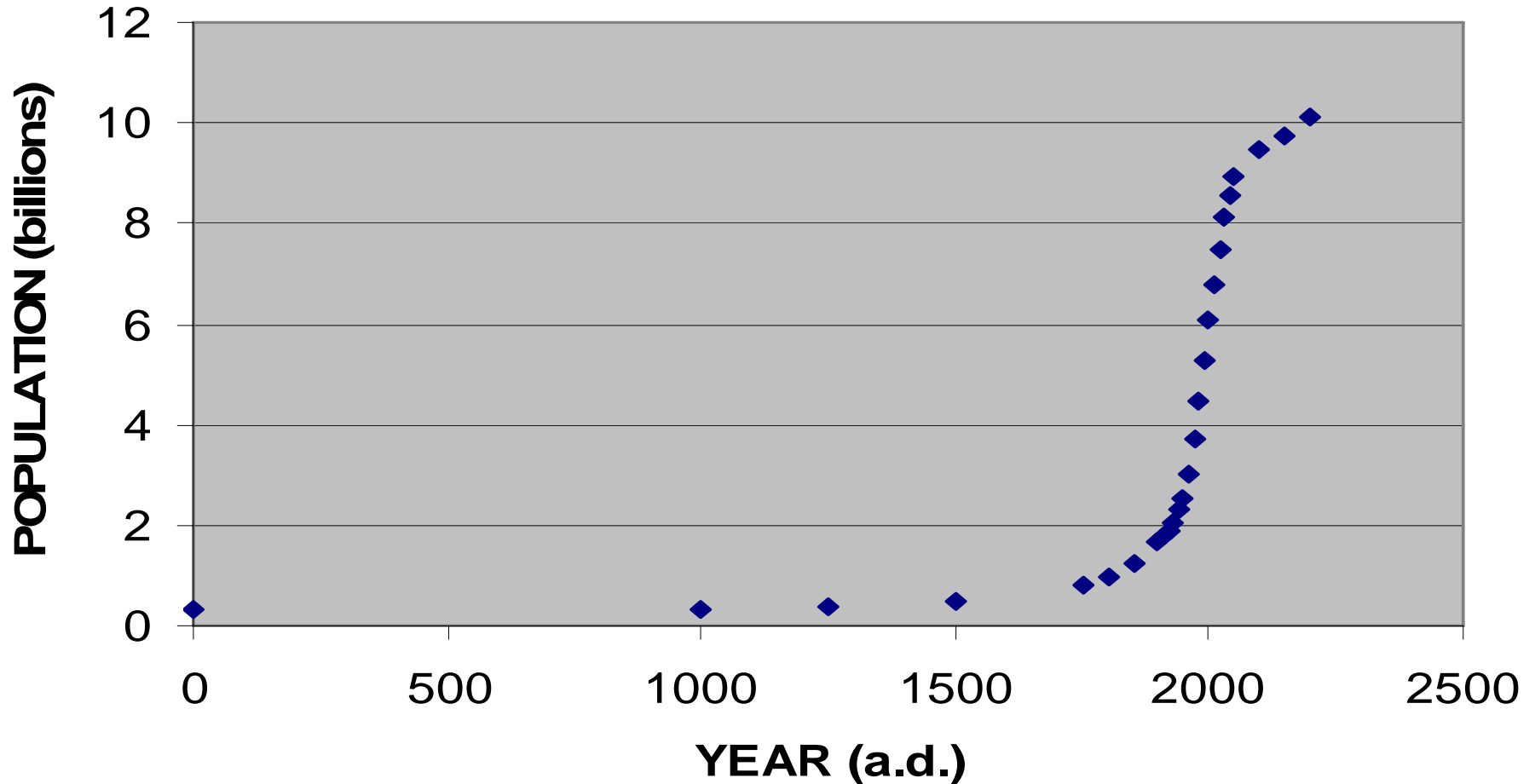
Ability to convert stranded HCs to transportable fluids (GTL, heavy oil conversion)

Impact of Recovery Efficiency increases on Production Availability

Short term (up to 5 years)	Very little, 0-2%
Medium term (5 to 10 years)	Some, ~ 5% by end of period
Long term (more than 10 years)	Increasingly significant, ~ 10% or more. <u>If new methods applicable in older fields</u> , increase could counteract natural decline for a few decades

***“Production will be demand limited”
Really?!!***

WORLD POPULATION GROWTH



THANK YOU!

Jerry Gilbert

Barrelmore Ltd.



‘Mankind was destined to live on the edge of perpetual disaster. We are mankind because we survive. We do it in a half-assed way – but we do it’

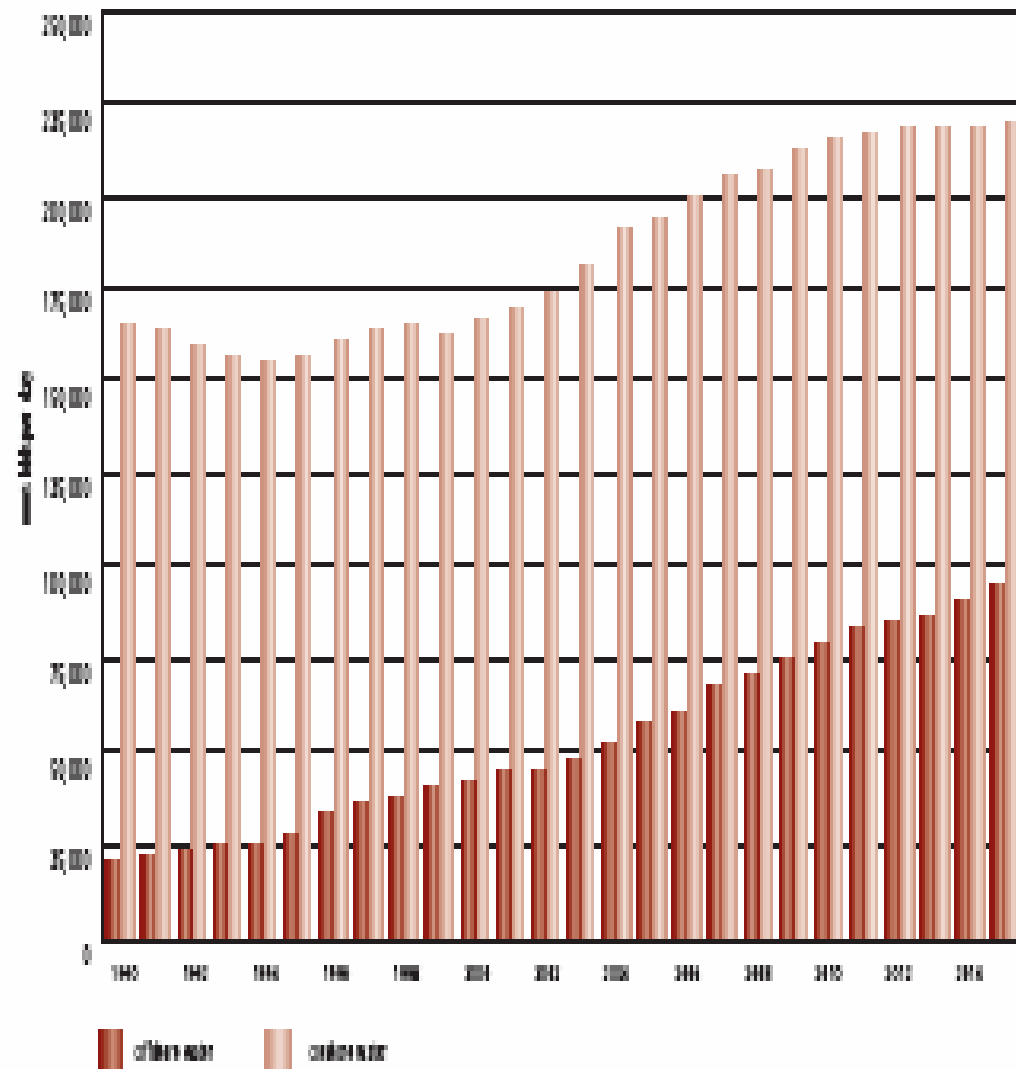
- James Michener

Enhancing Recovery Efficiency

Better control of water movement and production would conserve reservoir energy

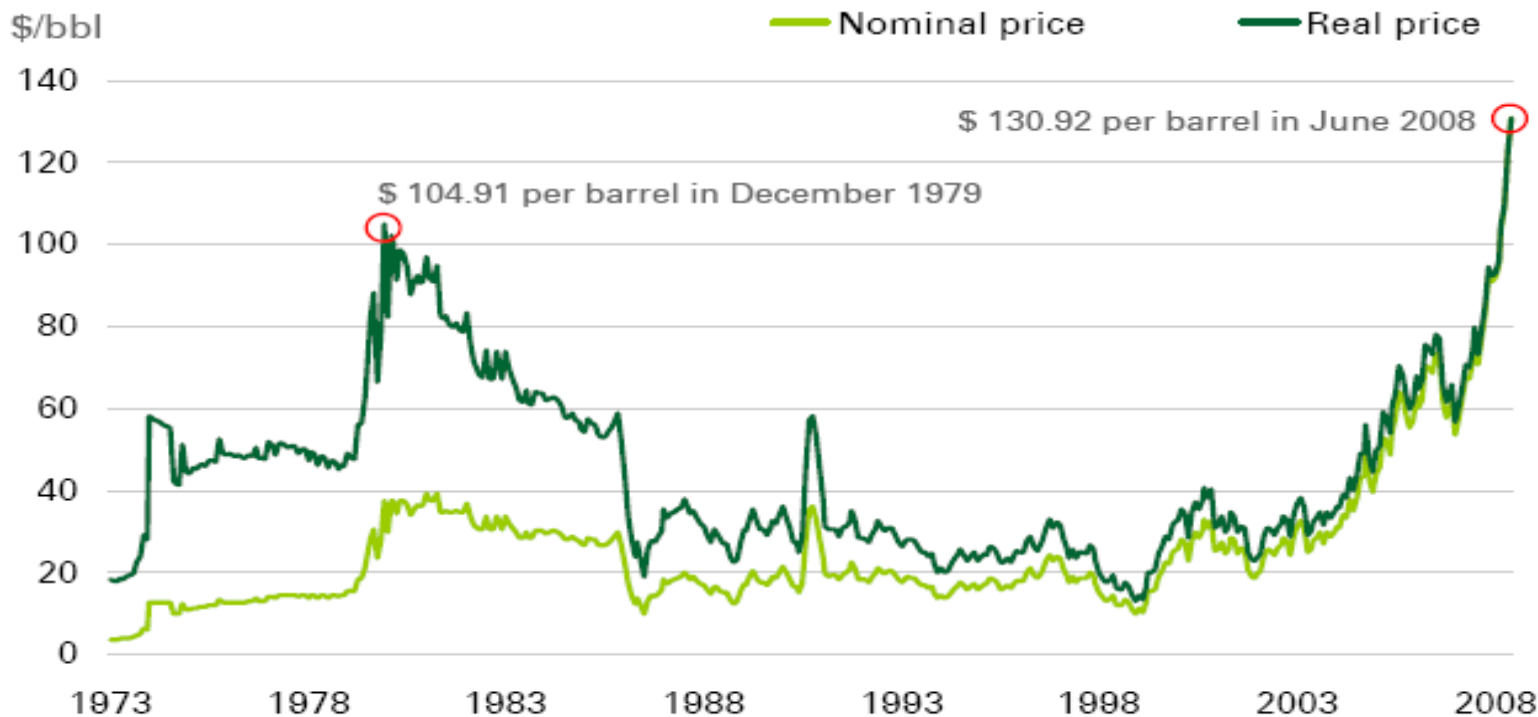
Globally, 250 million bbls of water produced; about 50 mmb in US – where 15,000 wells/year are abandoned for high water production

Figure 1: Global Onshore and Offshore Water Production



Oil Price and 'R. and D.'

Real and Nominal Crude Oil Price



R. + D.

LEADERS :

IOCs

X

Service

cos.

..... and

NOCs

ASPO-Estimated World Oil Supply

