

# Economic and Technical Changes Since Black Sunday 1982

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# Shale Oil SWOT Analysis

- Strength – Improved Position on Hubbert Curve
- Strength – Technology Advance
- Weakness – Loss/Outsourcing of Research Programs and Staff
- Threat – The Climate Change/Carbon Tax Debate
- Threat – Higher Environmental Hurdles
- Threat – NGO Activism (Greenpeace vs Stuart Project)

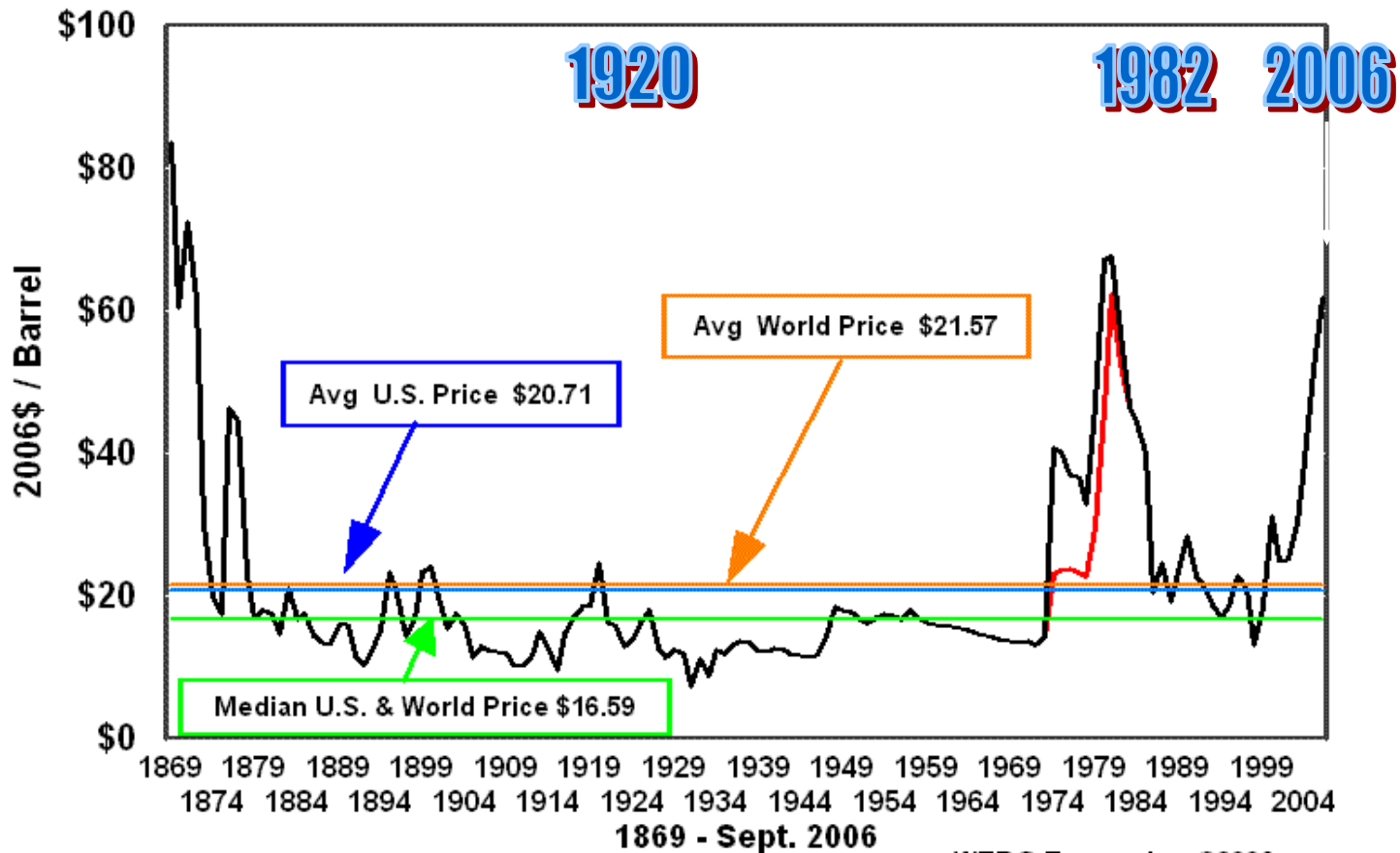


# Economics



# Real Crude Oil Prices

CRUDE OIL PRICES  
2006 DOLLARS



— U.S. FIRST PURCHASE (Wellhead) — World Price\*

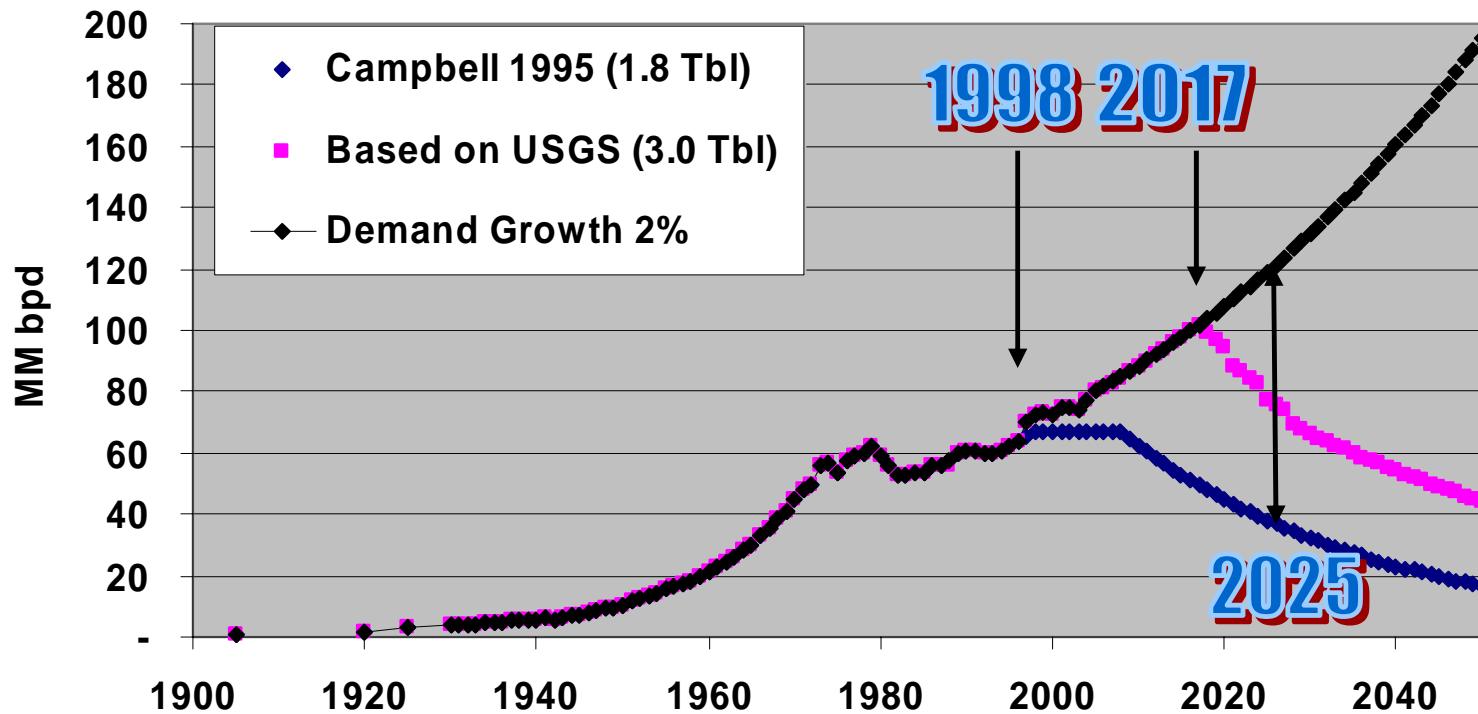
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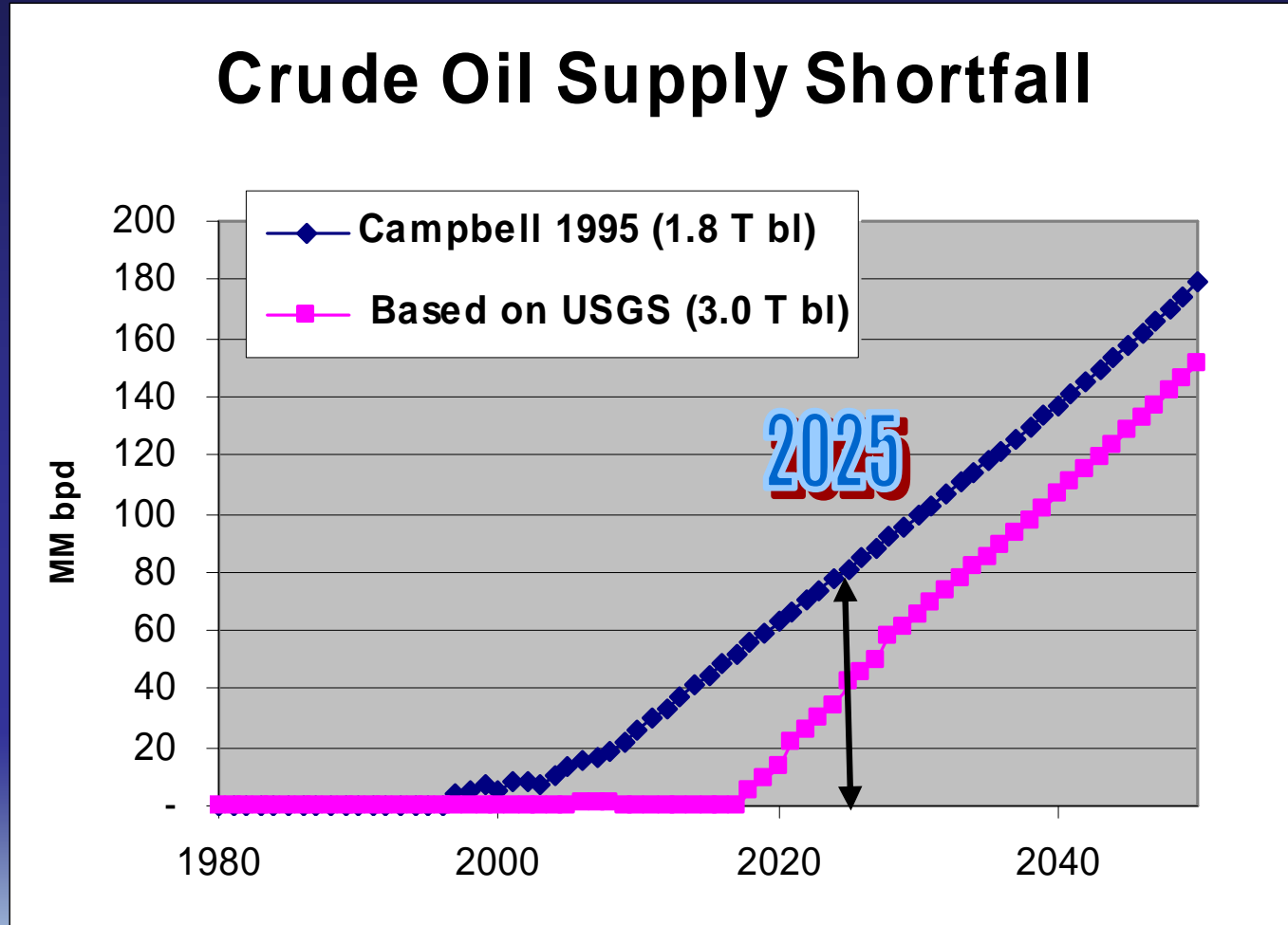
# Hubbert Curve Analysis

## Crude Oil Depletion and Demand



# Scope for Alternative Fuels

## Crude Oil Supply Shortfall



From 42 MM bpd to 81 MM bpd

# Where Will The Shortfall (42 to 81 MM bpd) Come From?

Coal to Liquids	Gas to Liquids	Tar Sands	Bio-Fuels	Oil Shale
<u>2006</u> 0.15 MMbpd	<u>2006</u> 0.06 MMbpd	<u>2006</u> 1.3 MMbpd	<u>2006</u> 0.6 MMbpd	<u>2006</u> 0.0 MMbpd?
<u>2025</u> 4.0 MMbpd	<u>2025</u> 1.0 MMbpd	<u>2025</u> 5.0 MMbpd	<u>2025</u> 3.0 MMbpd	<u>2025</u> 2.0 MMbpd?

*This Adds Up to Only 15 MMbpd!*

# Conclusions - Economics

- Analysis of Crude Oil Production by Hubbert Curve is Fraught with Uncertainty – and - Critically Important
- Shale Oil Will Have to Compete with Alternative Fuels (GTL, CTL, Tar Sands, Biofuels) as well as Crude Oil. Marginal Cost is Important.
- The Eventual Downside of the Hubbert Decline Curve Will Generate Huge Supply Shortfall (like 50 MM bpd by 2025)
- Past False Dawns (1920, 1980) for Shale Oil Have Hindered Development



# Technology



# Technology Advance

Comparison	1920	1982	2006	Ratio 1982:2006
Largest Open Pit Mine	7 MTPA (Bingham Canyon)	50 MTPA (Palabora)	400 MTPA (Grasberg, Escondida)	8X
Largest Underground Mine	1 MTPA Homestake ?	15 MTPA (El Teniente)	45 MTPA (El Teniente)	3X
Largest Haul Truck	1T ?	120 Tonne	360 Tonne	3X
Drilling Technology	Vertical Wells	Oriented Drilling	Horizontal Multilateral Wells	5X?
Information Technology	Slide Rule, Telegraph	HP 41C Calculator, Telephone	PC on Each Desk, Internet	10X?

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# Environmental/Social



# Environmental/Social Issues

<b>Comparison</b>	<b>1920</b>	<b>1982</b>	<b>2006</b>
<b>Air Emissions</b>	<b>No Controls</b>	<b>VOC Content Controlled</b>	<b>Multiple &amp; Tight Controls</b>
<b>Climate Change/Carbon Tax</b>	<b>None</b>	<b>None</b>	<b>Kyoto Accords for Some Countries</b>
<b>Influence of Activist NGO's</b>	<b>None</b>	<b>Little</b>	<b>Major Factor in Some Locations</b>
<b>Ground Water Contamination</b>	<b>Variable</b>	<b>Significant Concern</b>	<b>Greater Controls</b>
<b>Land Use Central Colorado</b>	<b>Few People Mining, Ranching</b>	<b>Rural Economy with Some Small Cities</b>	<b>Many Expensive Vacation Homes</b>

# Conclusions – Environmental/Social

- Progression From Total Organics (ie VOC) to Molecular Specifics (ie. Dioxin)
- Activist NGO's and Land Use Issues Make Some Locations Difficult (Colorado, Queensland)
- Climate Change Issues Represent a New Challenge
- Greater Sophistication Exists for Environmental Monitoring and Social Consultation



# Final Conclusions

- Shale Oil Will Have to Compete With Other Alternate Fuels as Well as Crude Oil
- Currently, Shale Oil has Fallen Behind the Other Alternate Fuels
- Mining and Associated Technology Has Improved, But Loss of Expertise Has Hurt the Shale Oil Industry
- Rhetorical Question: Did the Shale Oil Industry Have Greater Capacity in the 1970's?

