

Economic and Technical Changes Since Black Sunday 1982

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Shale Oil SWOT Analysis

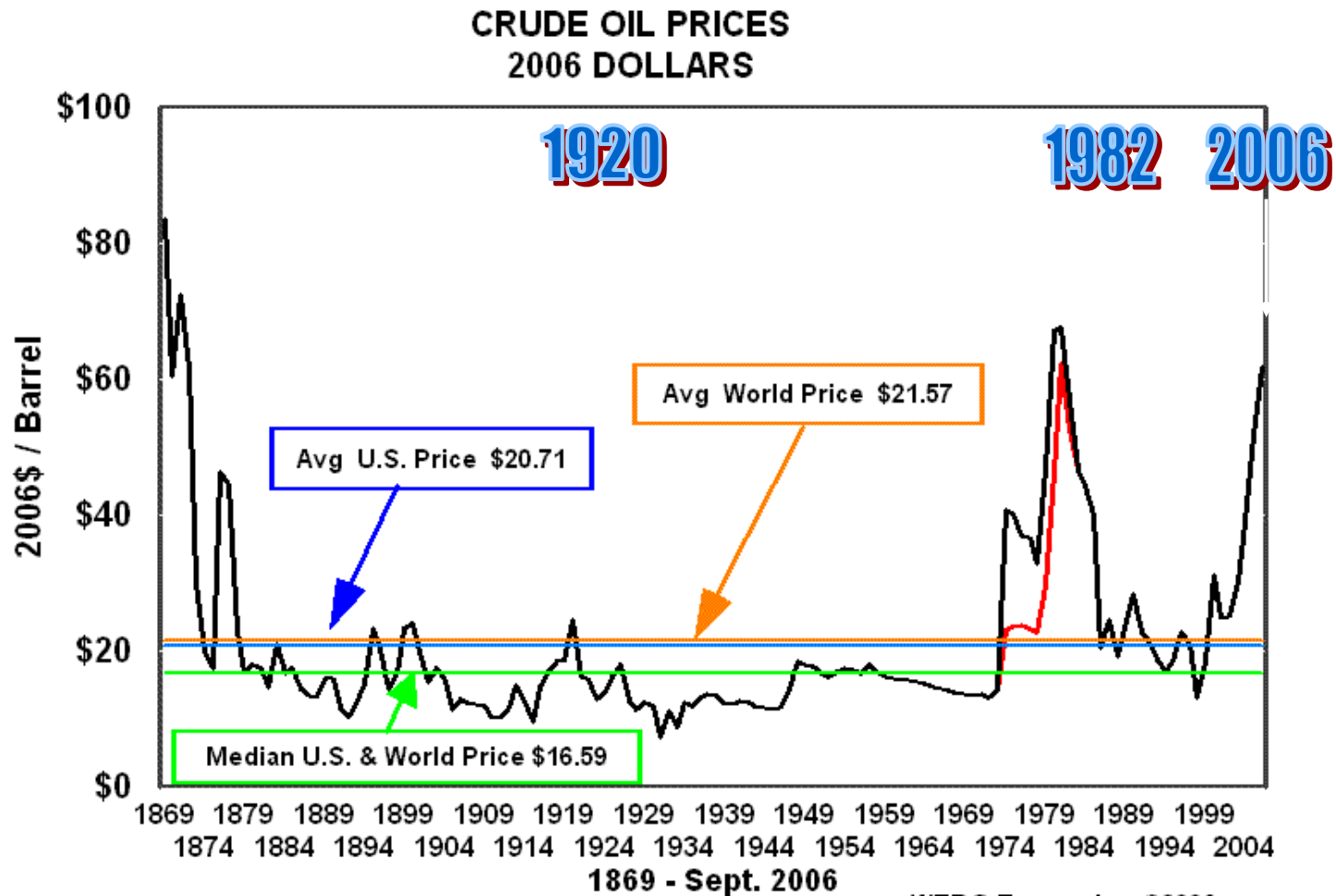
- Strength – Improved Position on Hubbert Curve
- Strength – Technology Advance
- Weakness – Loss/Outsourcing of Research Programs and Staff
- Threat – The Climate Change/Carbon Tax Debate
- Threat – Higher Environmental Hurdles
- Threat – NGO Activism (Greenpeace vs Stuart Project)



Economics



Real Crude Oil Prices



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

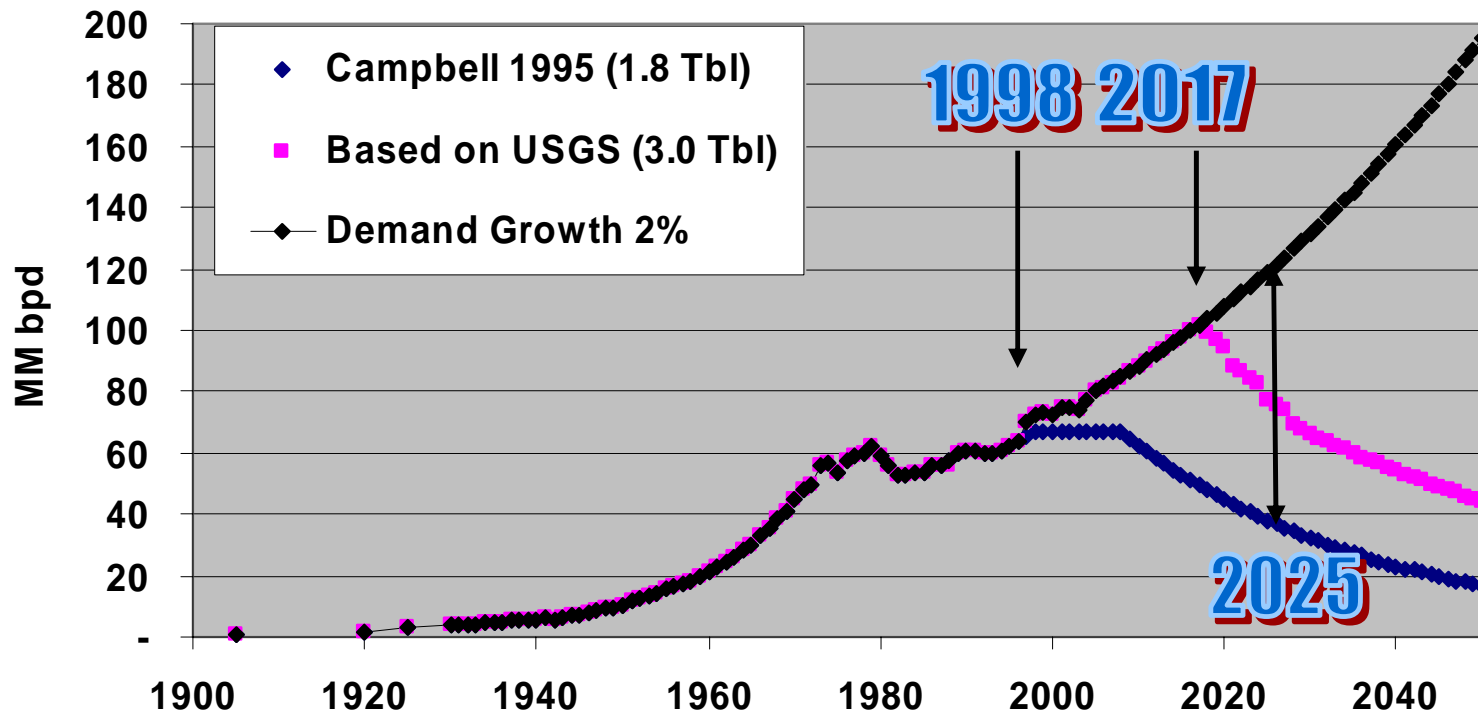
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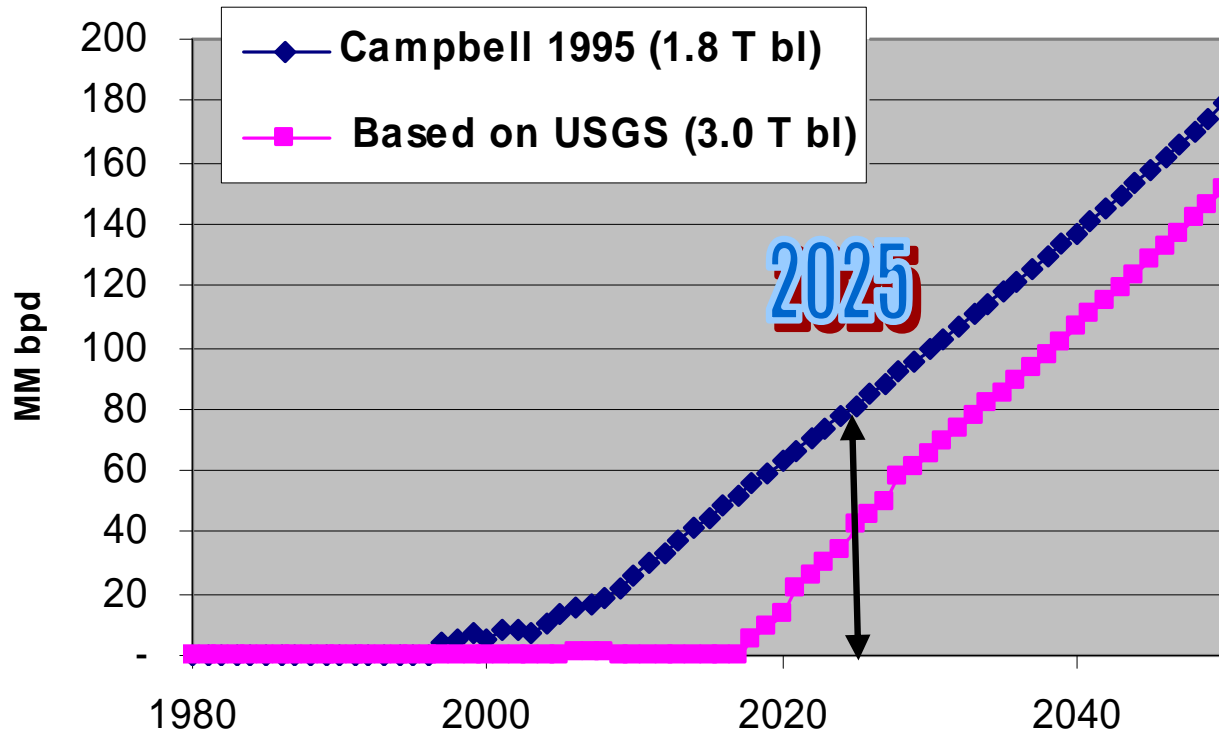
Hubbert Curve Analysis

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

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

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?

