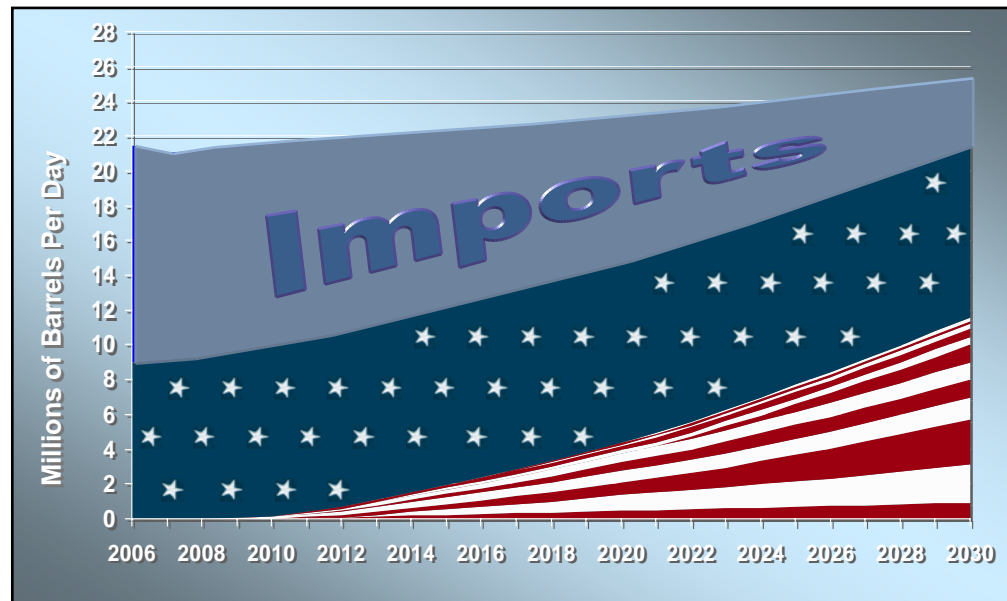


Liquid Fuel Security Through Diverse Energy Alternatives



Carl O. Bauer, Director

National Energy Technology Laboratory



Office of Fossil Energy

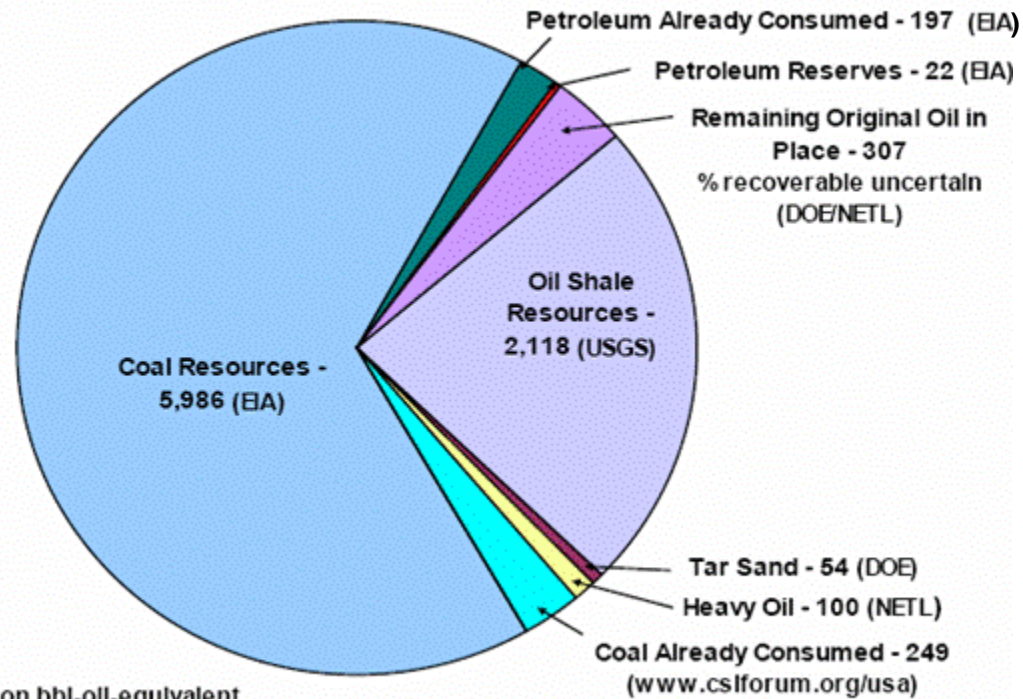
December 12, 2006



America's Endowment of Solid and Liquid Fuels Resources



U.S. Hydrocarbon Resources
(Total endowment 9,033 billion bbls oil equivalent*)



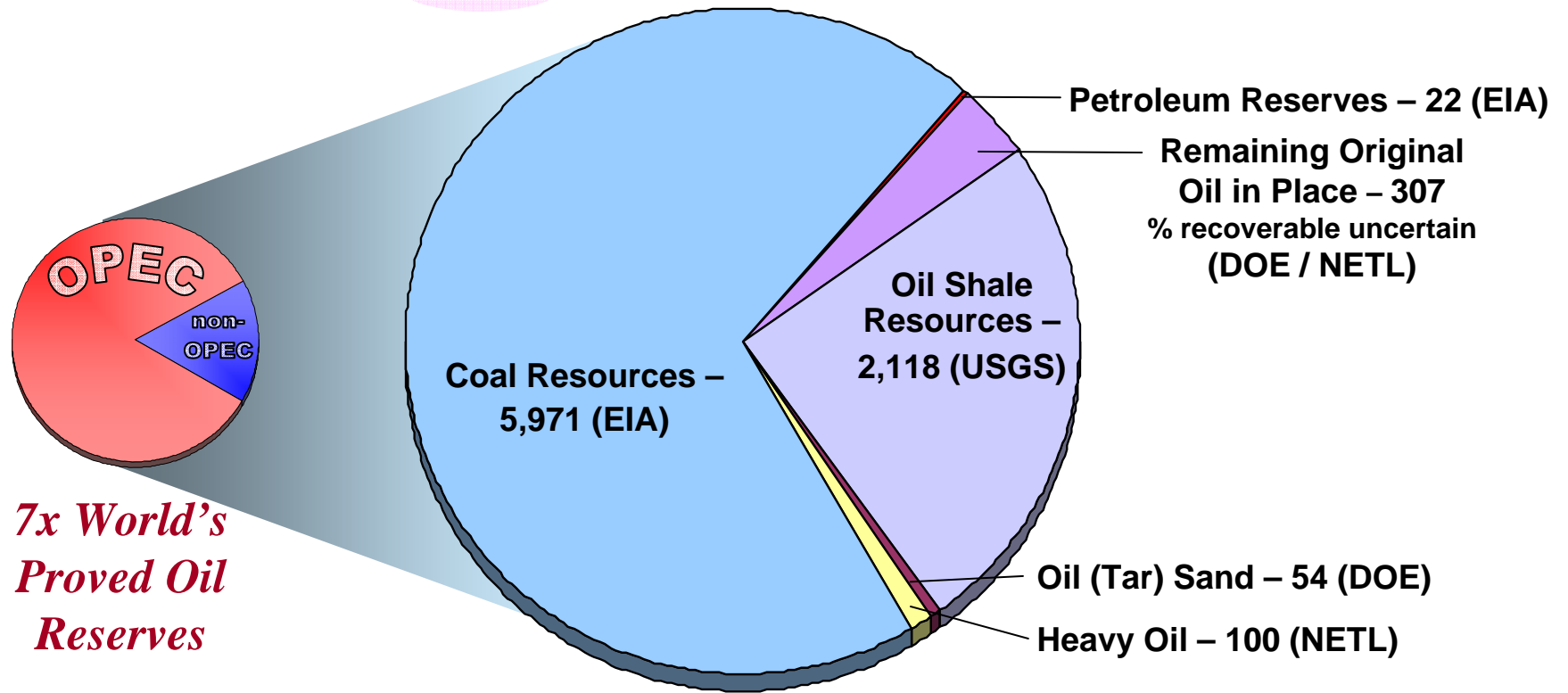
Units are in billion bbl-oil-equivalent
coal - 10K BTU/lb; oil - 6M BTU/bbl,
Source: JWBA, 2005.

*not including energy losses in transformation to liquid fuel

U.S. Resources Much Larger Than World's Proved Oil Reserves

U.S. Hydrocarbon Resources

(Total remaining endowment 8,572 billion bbls oil equivalent*)

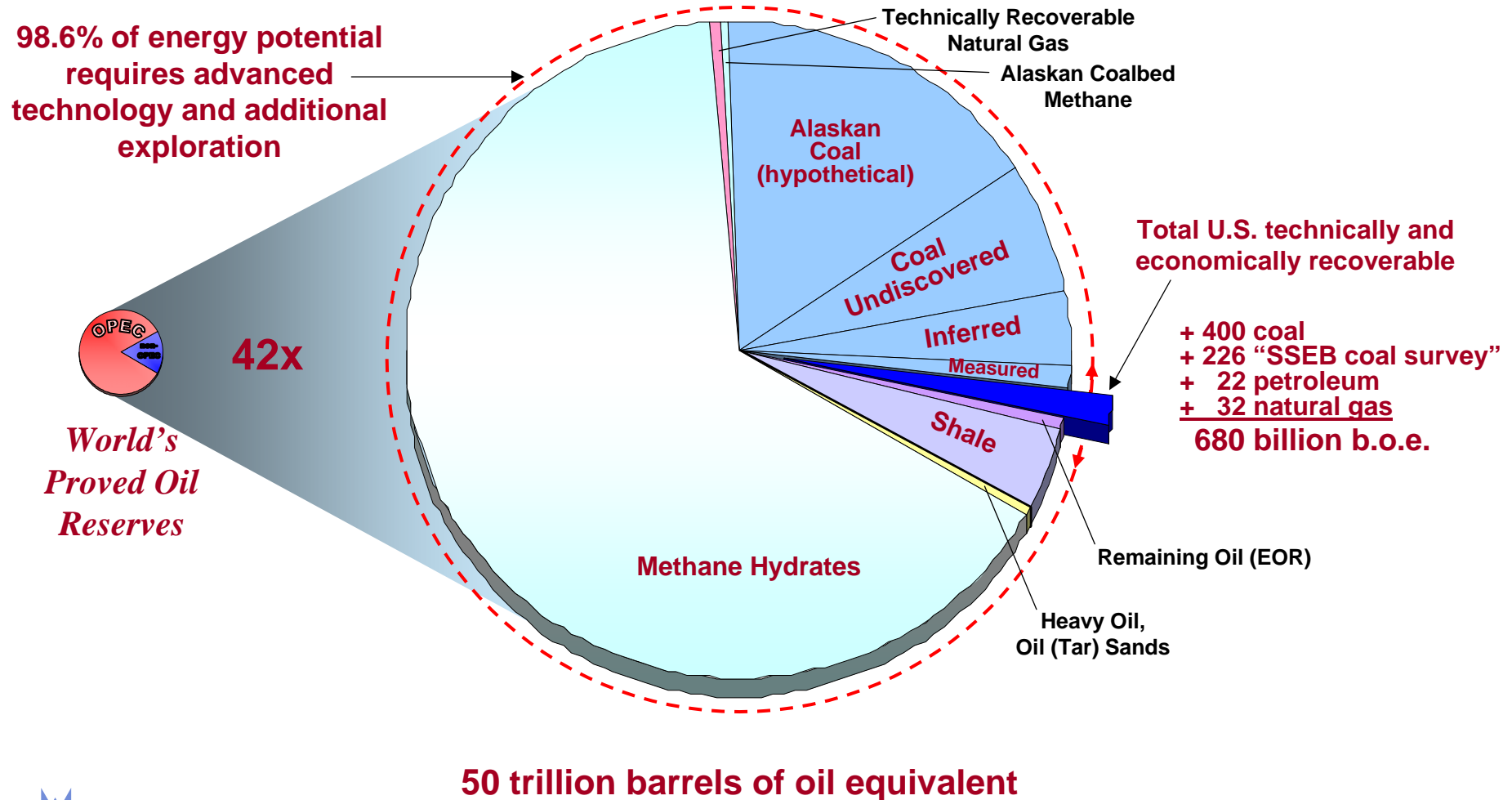


Units are in billion bbl-oil-equivalent
 coal – 10K BTU / lb
 oil – 6M BTU/bbl

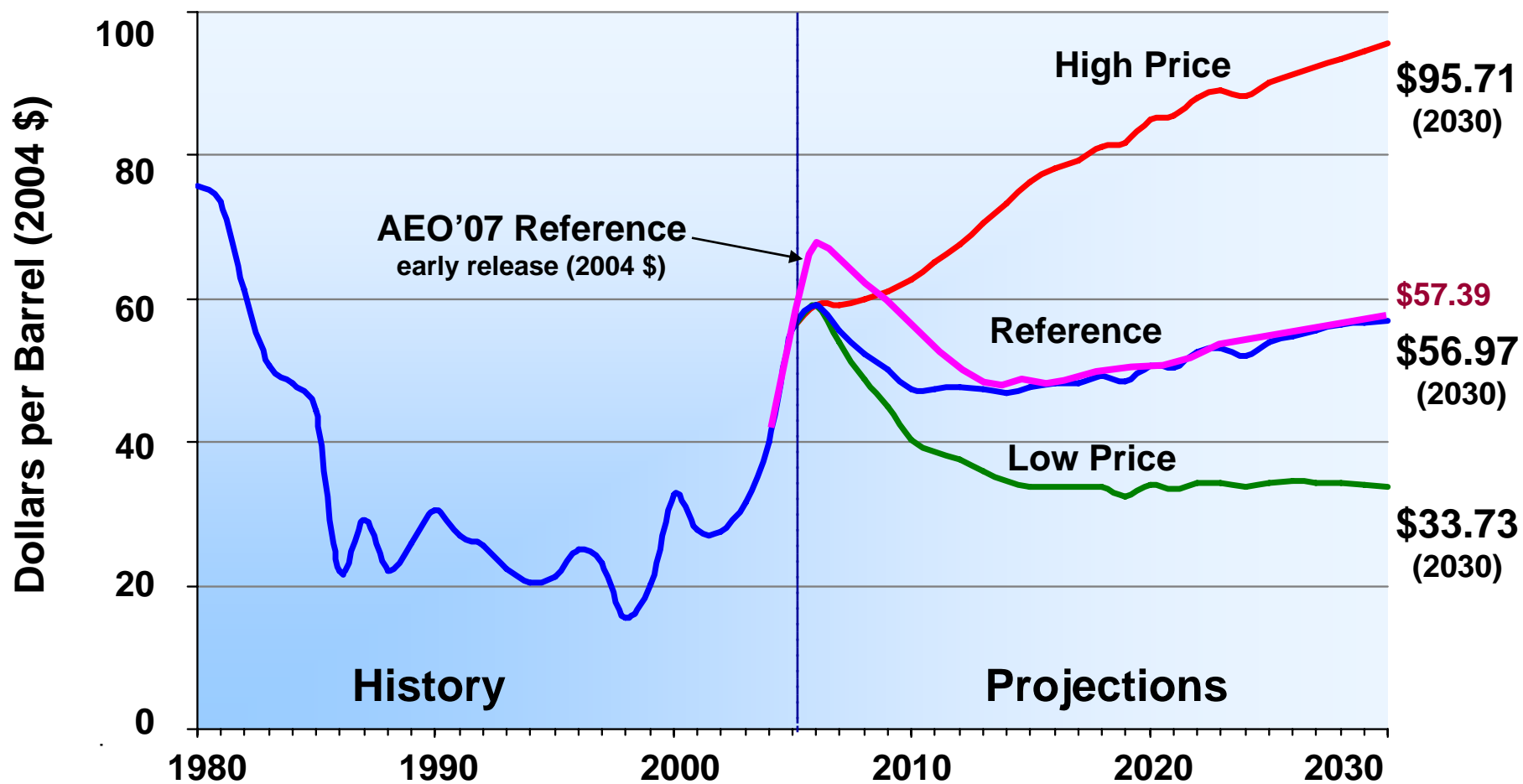
*Not including energy losses in transformation to liquid fuel

Reference: D. Garman June 15, 2006 CSIS presentation, slide 26, excluding fuel already consumed and coal updated per EIA 2004; BP Annual Energy Review

U.S. Endowment of Solid, Liquid, and Gaseous Fuels Resources



World Oil Prices in Three Cases (AEO'06)

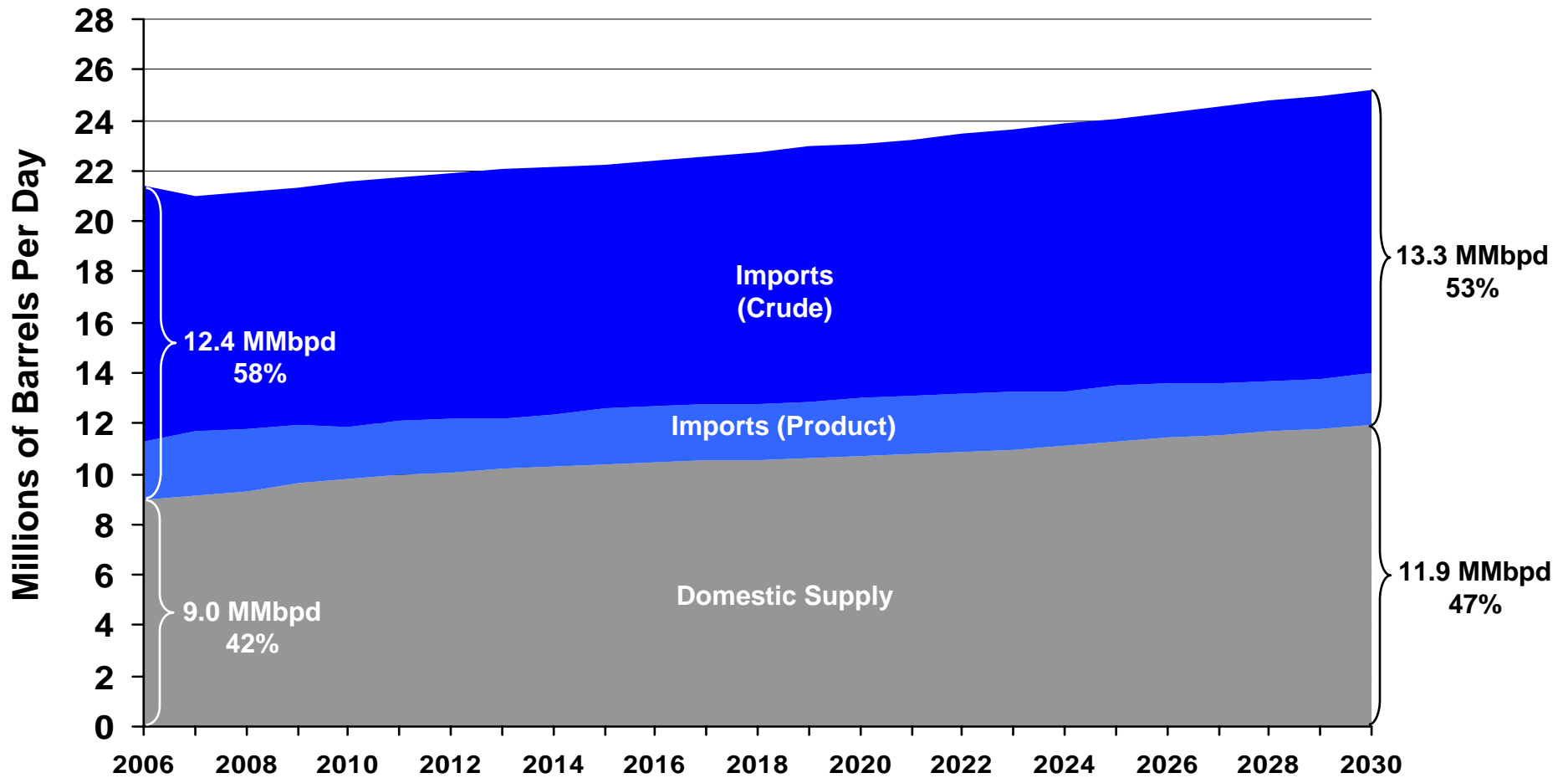


High Price Case Considered in NETL Energy Alternatives Analysis

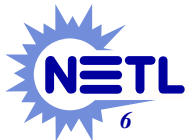


Liquid Fuels Energy Security

Total Supply AEO'06 (High Oil Price)

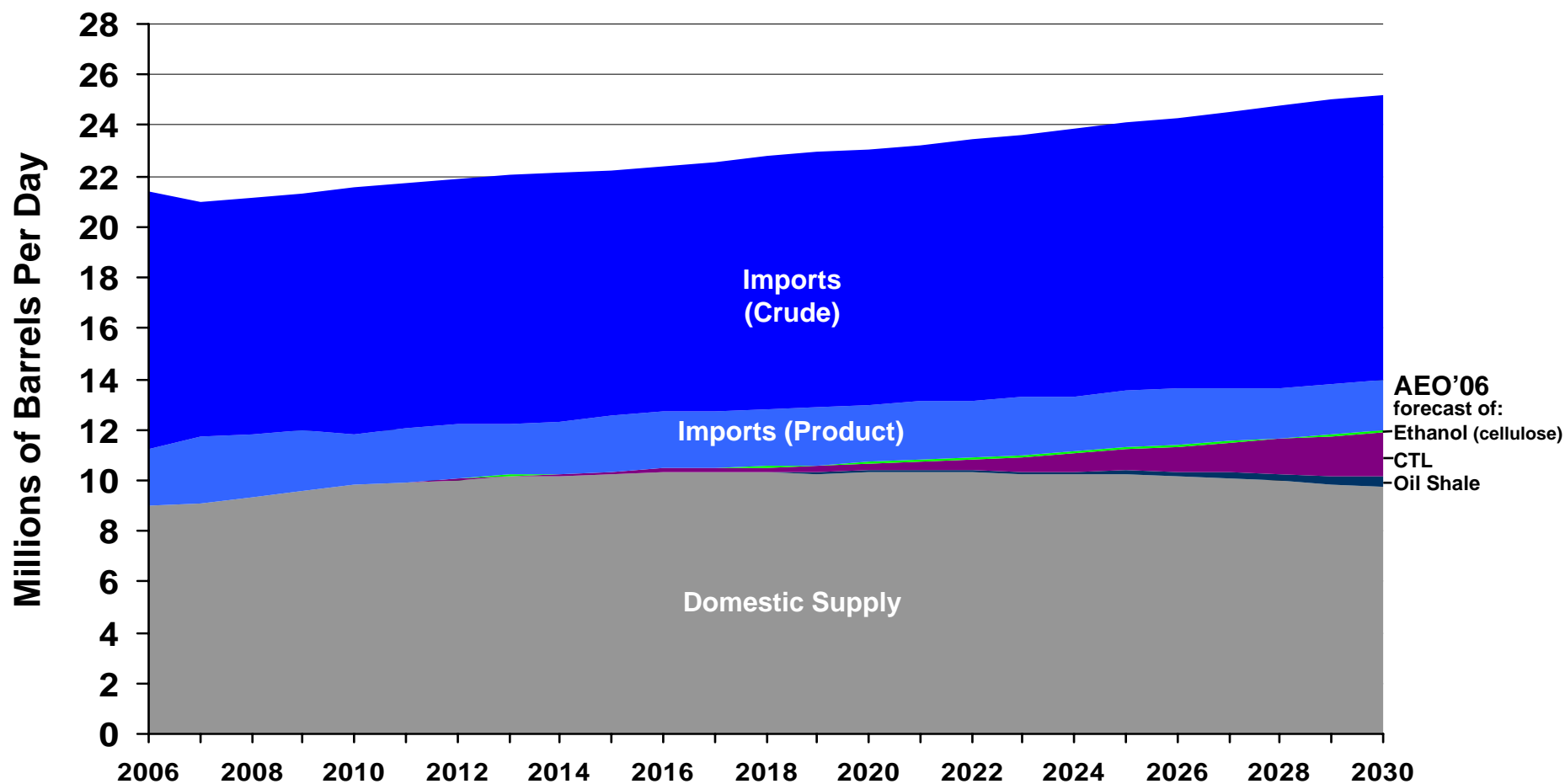


Imports Remain >50% of Liquids Supply

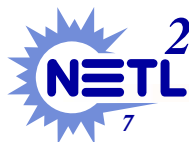


Liquid Fuels Energy Security

Total Supply AEO'06 (High Oil Price)

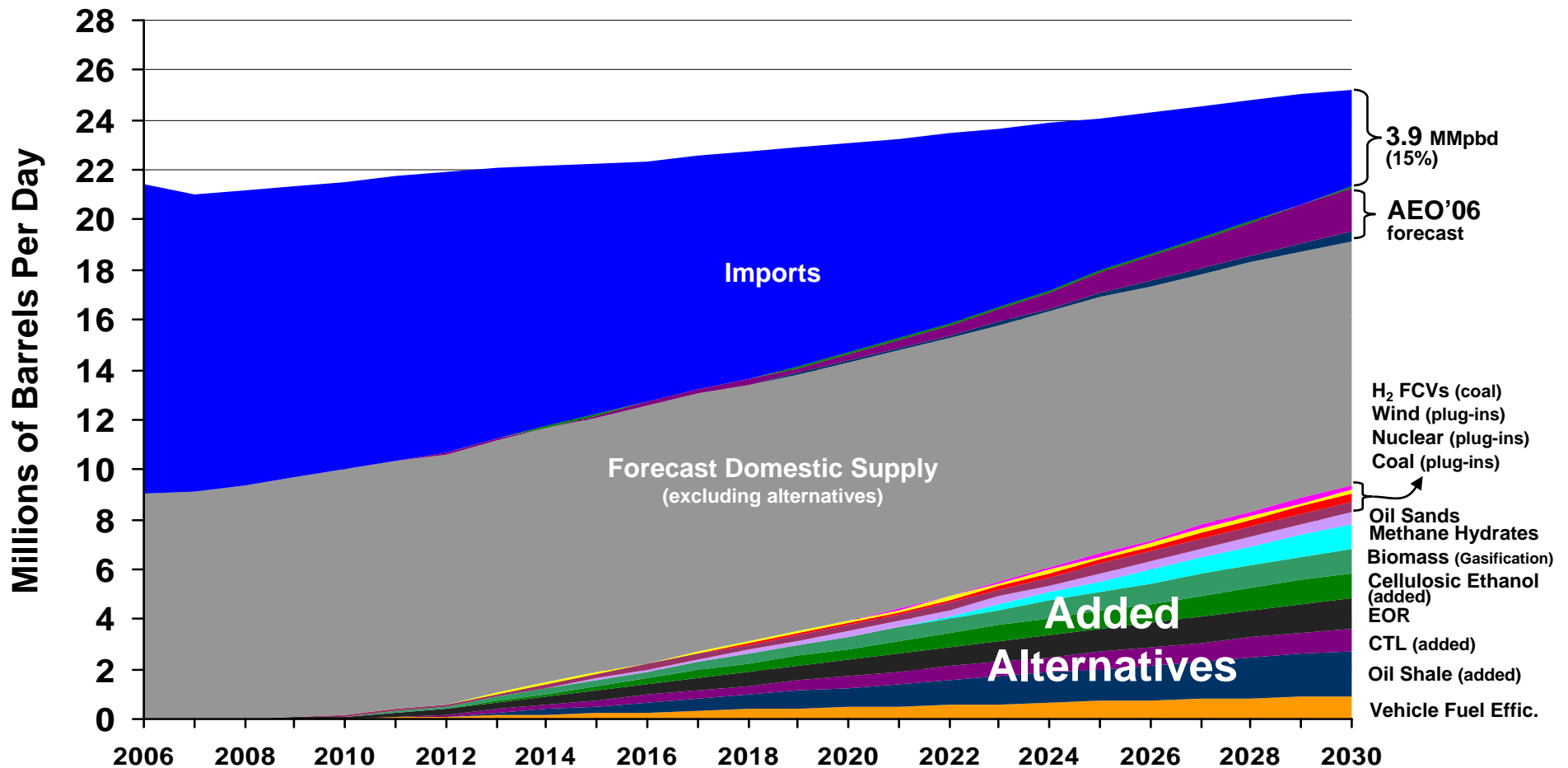


2.2 MMbpd of CTL, Oil Shale, and Cellulosic Ethanol Added (2030)



Cumulative Domestic Energy Alternatives Supporting U.S. Liquids Supply


Total Supply AEO'06 (High Oil Price Case)



Significant Cumulative Potential for Reduction in Import Reliance
(9.4 MMbpd additional reduction in imports relative to AEO'06 High Oil Case)

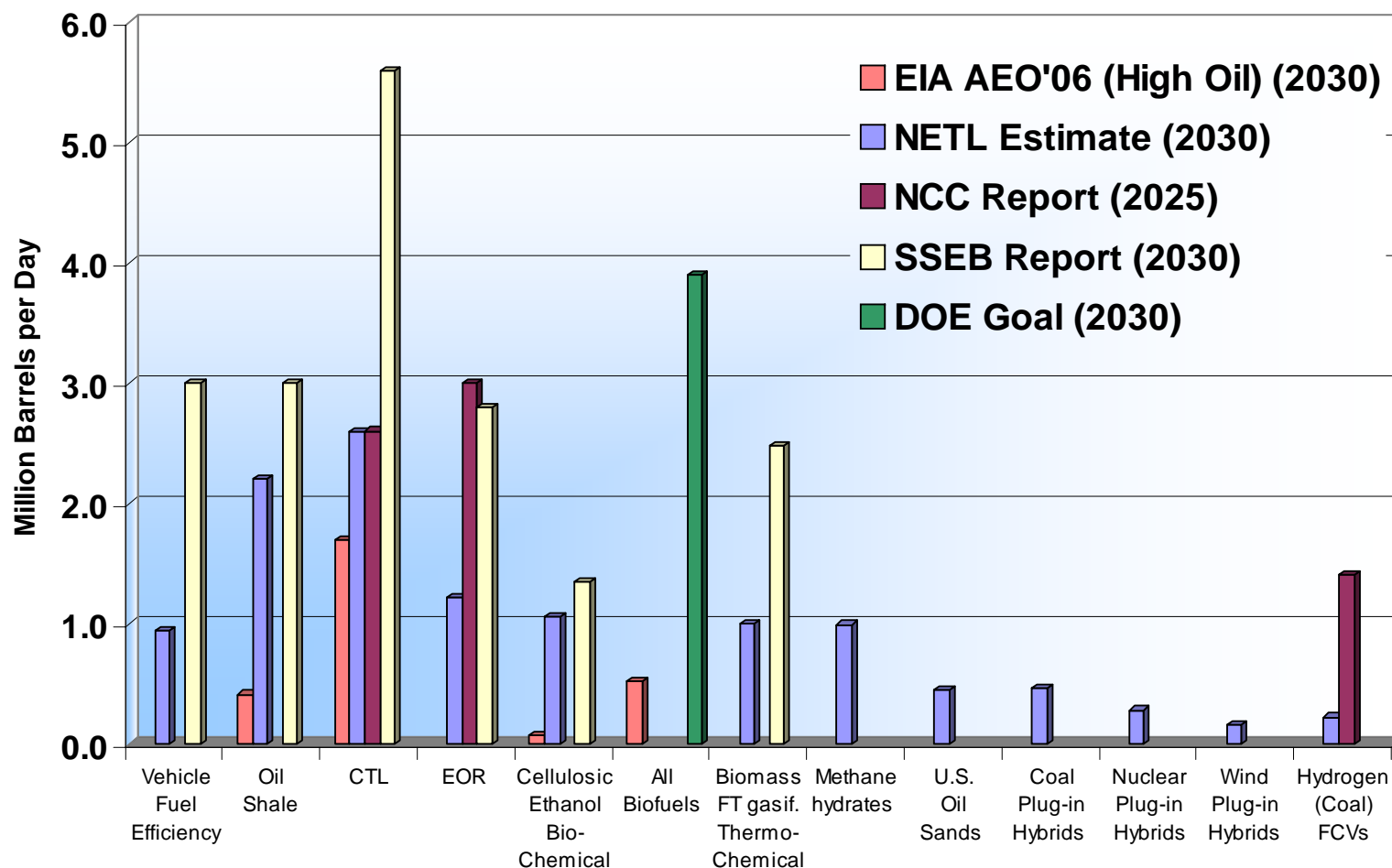


“Advantageous Interdependence”

- 
- “Advantageous Interdependence” reflects a market with sufficient domestic energy alternatives to drive imported energy prices to be more competitive and less volatile; the U.S. becomes a price setter rather than a price taker
 - “Energy Independence” sets bar too high; implies foreclosed access to competitive imports
 - Traditional “Interdependence” disadvantageous for consuming nations
 - Energy security is enhanced by confirming viability of key domestic alternatives, while leaving a moderate level of imports desirable

Cumulative Impact of Energy Alternative Development by Large Consuming Nations Helps Develop Demand Leverage in Global Market

Diverse / Conservative Energy Alternatives Offer Significant Cumulative Import Displacement



Individual Goals Below Most Other Estimates; Imports Reduced to 15%; Envisions All Potentially Significant U.S. Energy Resources Contributing

Summary

- **Extent of potential domestic energy resources needs to be adequately recognized; but $\approx 99\%$ require advanced technology and added exploration**
- **Technological hurdles are surmountable; major U.S. energy resources should be reasonably envisioned in energy forecasts**
- **Diverse alternatives permit conservative individual goals and diversity supports energy security**
- **Developing domestic energy alternatives can lead to “Advantageous Interdependence”**

