

ECONOMIC IMPLICATIONS OF LIQUID FUEL MITIGATION OPTIONS IN THE USA

**Presented at the “Time for Action:
A Midnight Ride For Peak Oil”**

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THIS PRESENTATION

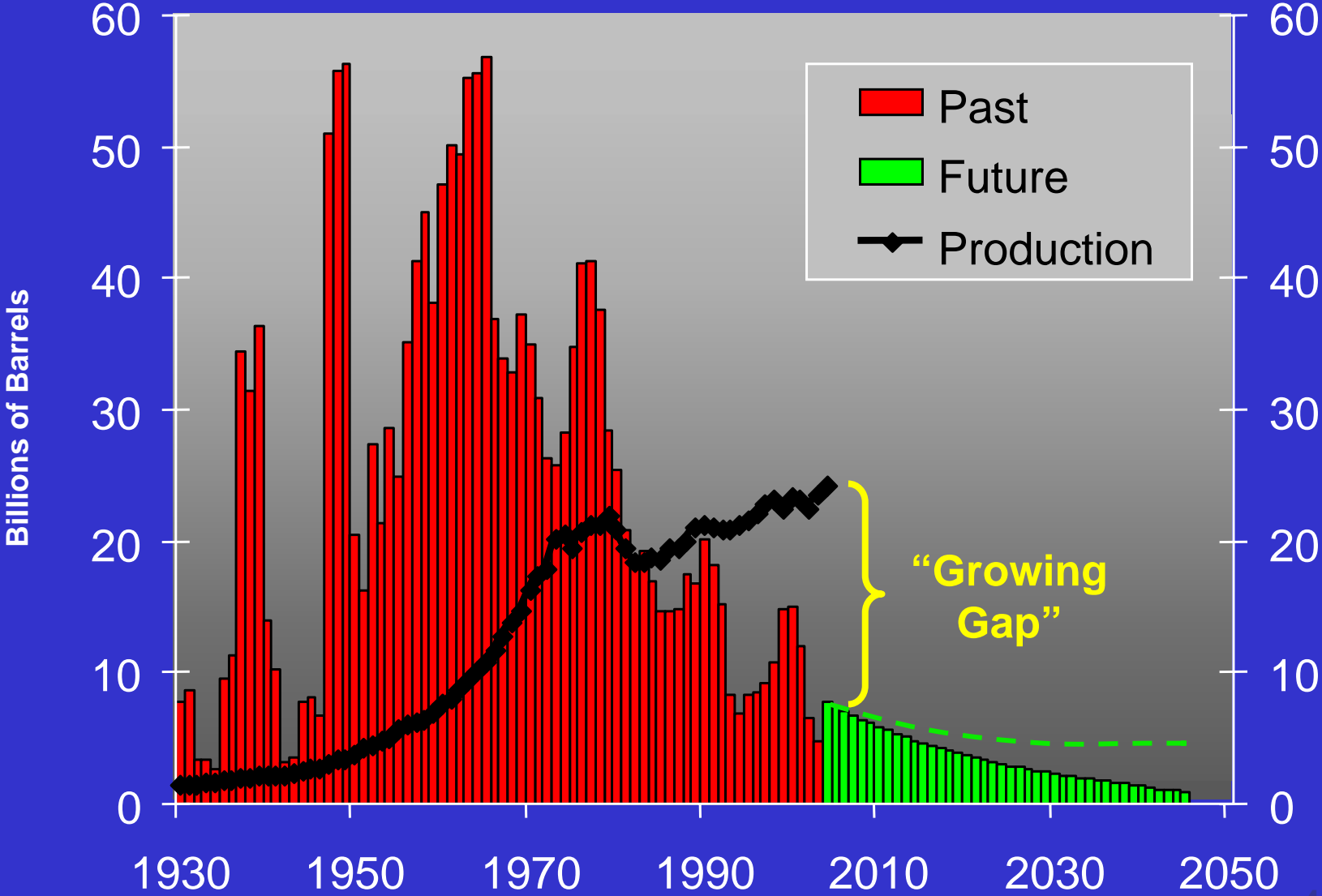
- **Economic Implications of Peak Oil**
- **Summary of 2006 U.S. Peak Mitigation Study**
- **Recent U.S. Oil Import Reduction Study Results**
- **Findings and Conclusions**
- **Questions and Caveats**
- **U.S. Government Progress on Peaking**

Views are the author's, except where noted



No, we're facing a liquid fuels crisis

World is Consuming More Oil and Finding Less

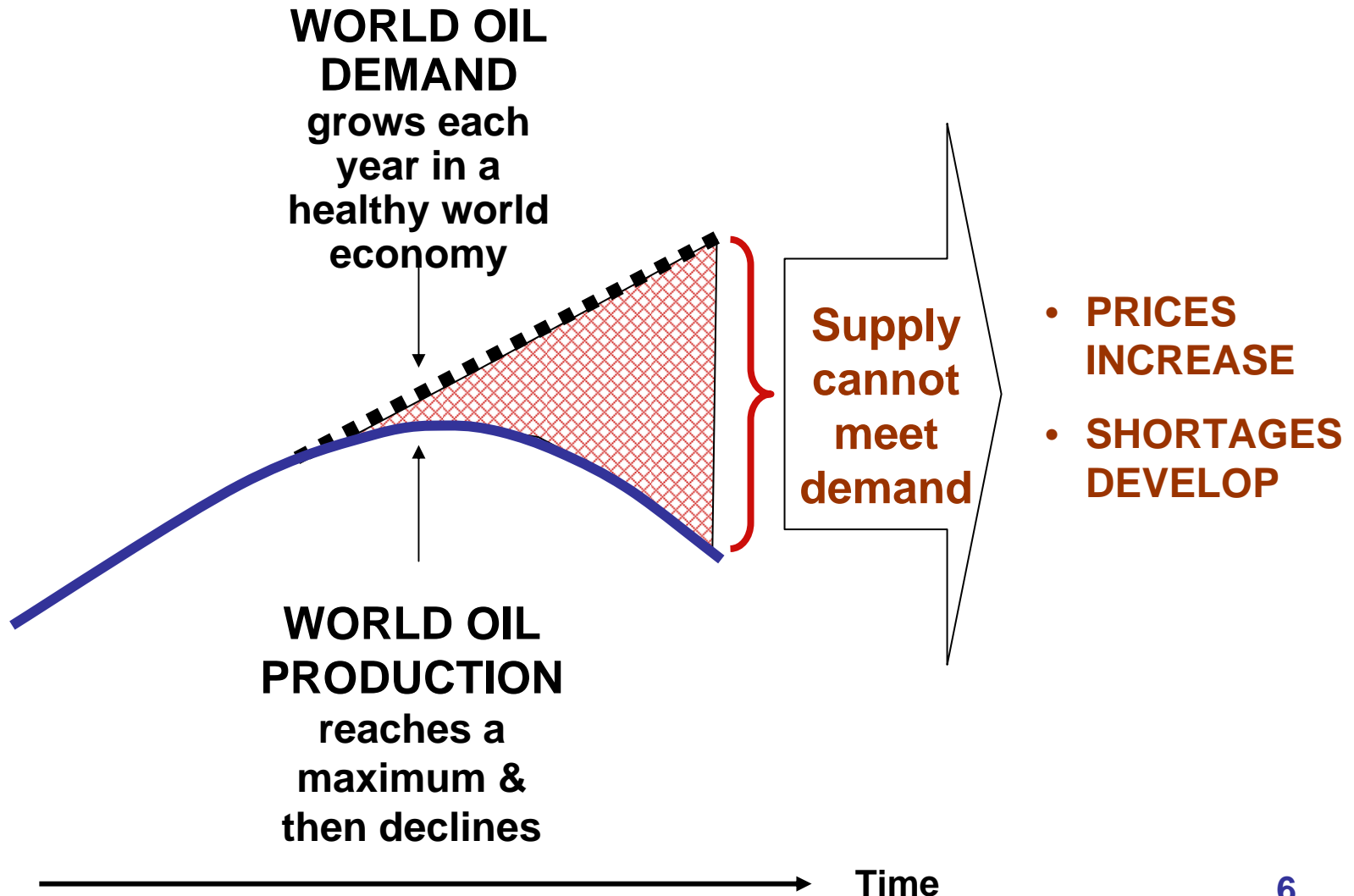


When Will Peaking Occur?

Different Approximations Lead to Different Forecasts

<u>Forecast</u>	<u>Source</u>	
December 2005	Deffeyes (U.S.)	Already
2006-2007	Bakhitari (Iran)	
2006-2007	Simmons (U.S.)	
2009 - 2010	Skrebowski (U.K.)	5 years
2010	Campbell (Ireland)	
Before 2010	Goodstein (U.S.)	
After 2010	World Energy Council	
2012	Weng (China)	5-15 years
2016	Doug-Westwood (U.K.)	
After 2020	CERA (U.S.)	
2030 or later	EIA (U.S.) / Exxon Mobil	> 20 years

What Might Happen at Peaking?

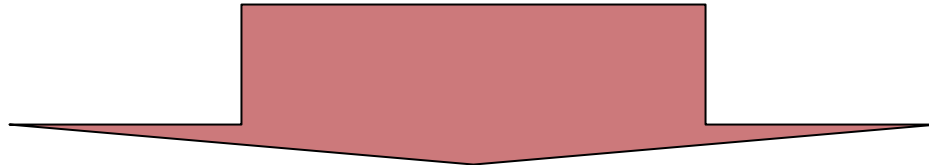


Learning from Two Oil Shortage Events

- **BRIEF** oil interruptions in 1973 & 1979 caused....

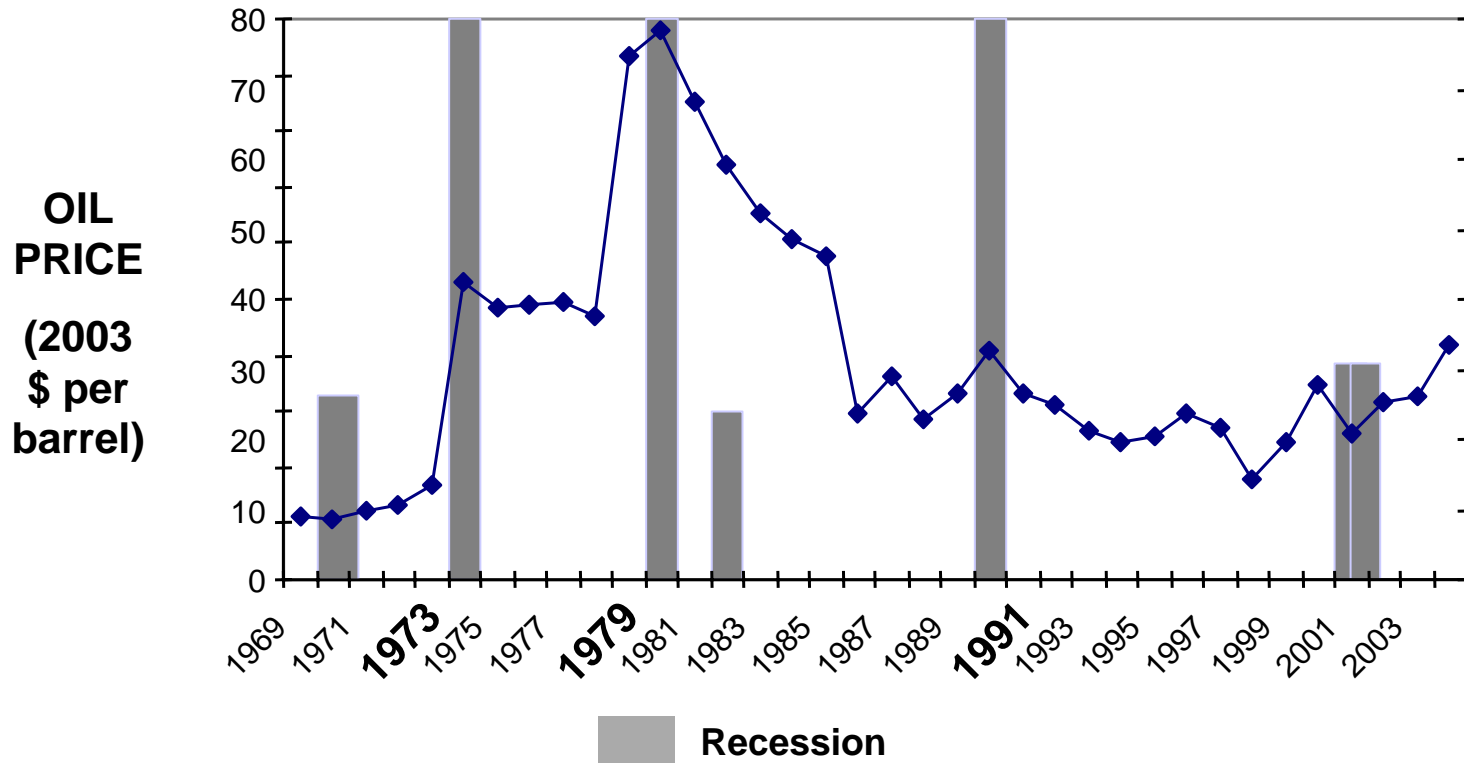
+ Inflation + Recession
+ Unemployment + High interest rates

- World oil peaking impacts could last for **DECADES.**



**The world's first forced energy transition.
No quick fixes!**

OIL PRICE INCREASES HAVE CAUSED U.S. RECESSIONS



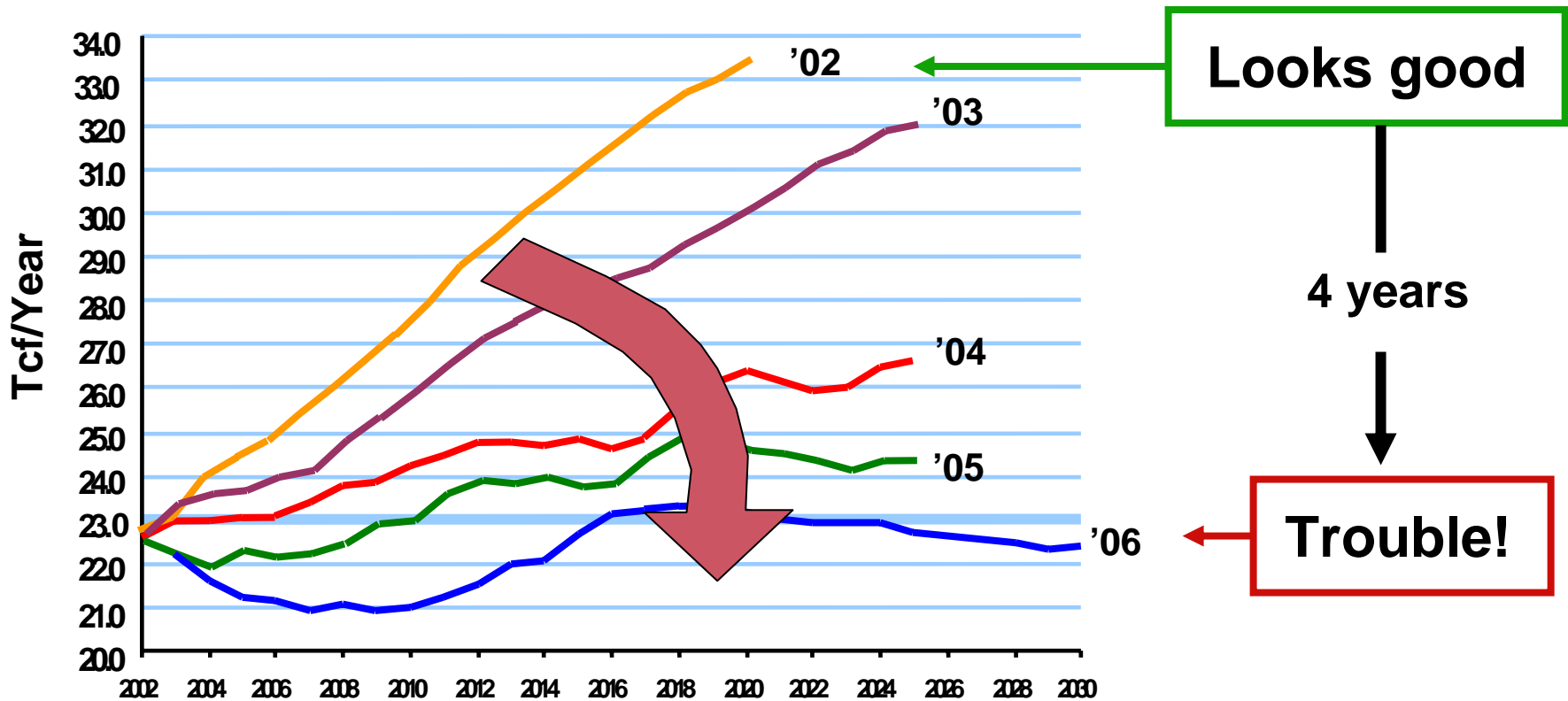
Over 30 years, four recessions followed oil price spikes.

**Remember the 1970s?
Stagflation. . . recession.
That was only a short-term disruption.**



Forecasting Oil & Gas Supply Is Difficult!

DOE EIA Forecasts of N. American Natural Gas Supply to U.S.



U.S. EIA says no world oil problem before 2030.

Two Studies of Mitigation Options

Both studies prepared for the U.S. DOE, National Energy Technology Laboratory

February 2005 study (“Hirsch Report”)

- Assessed world mitigation supply and demand options
- Analyzed three mitigation scenarios
- Derived policy implications for required mitigation timeframes

July 2006 study (“Bezdek Report”)

- Assessed economic implications in U.S.
- Estimated detailed impacts of four mitigation options
- Derived policy implications for U.S.

2006 Study Objective & Approach

- Explore imported oil reduction and/or peak oil mitigation -- U.S. only
 - + Time required to save & produce liquid fuels
 - + Costs
 - + Economic, fiscal, tax, & jobs impacts.
- Assumed crash program implementation to define a best case.
- Adopted an unspecified starting date – “ t_0 .”

Physical Mitigation Options & Their Applicability

Option	Worldwide Study	U.S. - Only Study
Vehicle Efficiency	✓	✓
Coal-To-Liquids	✓	✓
Enhanced Oil Recovery	✓	✓
Heavy Oil/Oil Sands	✓	Small
Gas-To-Liquids	✓	U.S. an Importer
Shale Oil	Not Ready	✓ Assumed ready

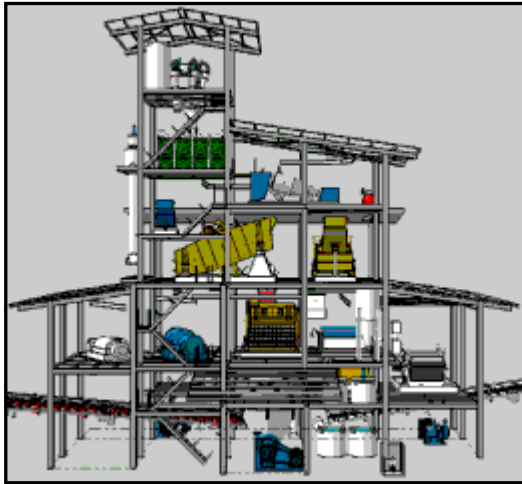
Implementation Assumptions

Mitigation Technology	Previous Assumptions for the World	Assumptions for the U.S. in This Study
Vehicle fuel efficiency	Ramping up to a 50% increase in vehicle fuel efficiency after 8 years	Same
Coal-to-liquids	<u>Five (5)</u> new 100,000 bpd plants/yr. 4 years to build	<u>Three (3)</u> new 100,000 bpd plants/yr. 4 years to build
Enhanced Oil Recovery	World oil production increased by 3 mbpd after 10 years / 5 year delay	175,000 bpd each year after 4 years construction delay
Oil Sands/Heavy Oil	2.5 MM bpd of incremental production achieved 13 years from a decision to accelerate	None
Gas-to-liquids	1 mbpd achieved in 5 years	None
Oil Shale	None	3 new 100,000 bpd plants/yr. 8 year delay

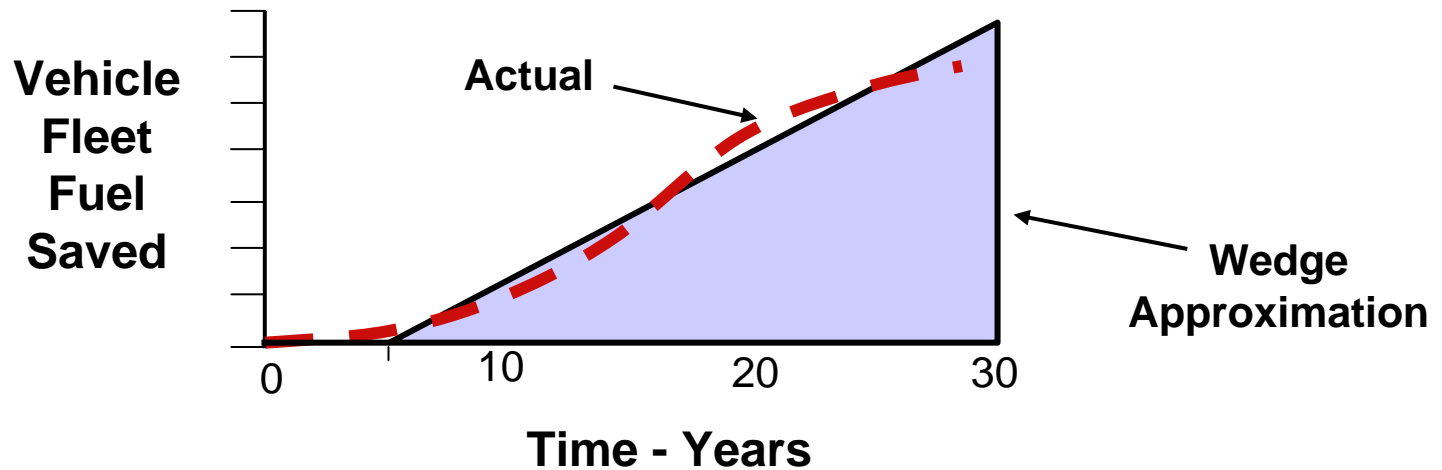
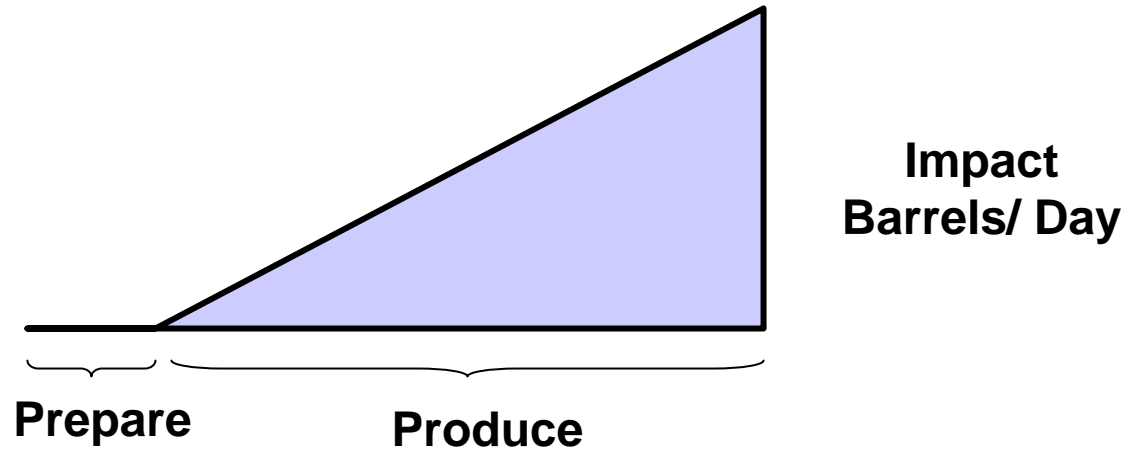
Methodological Approach & Databases

- **Well-Established Models**
 - + MISI economic model & databases
 - + U.S. Commerce Dept. models
 - + Census Bureau/BLS industry/occupation data
- **Labor force data within each industry for 800 occupations and skills**
- **State and regional data**

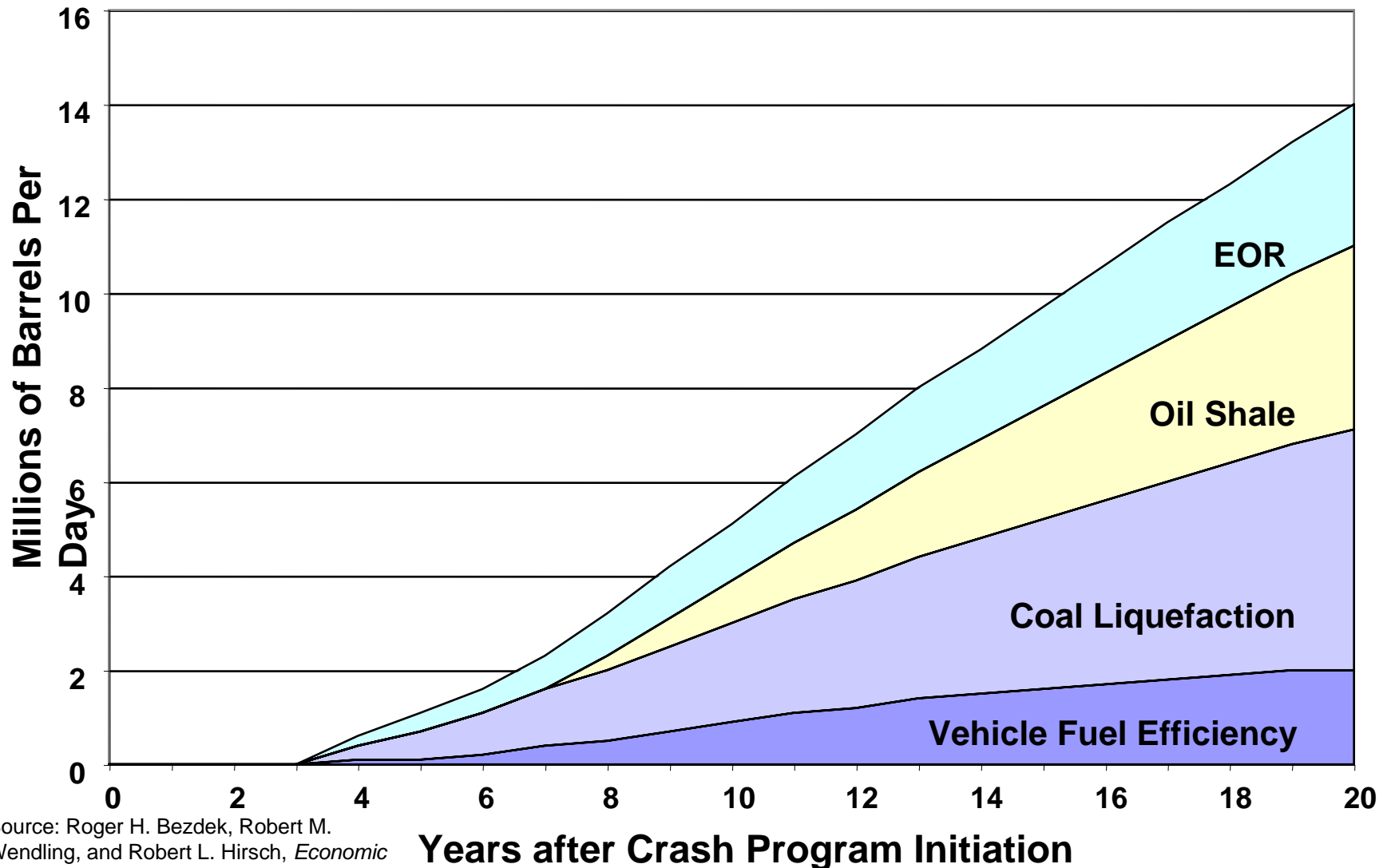
Coal, Oil Shale, and Alternative Liquid Fuel Plants



The Delayed Wedge Model

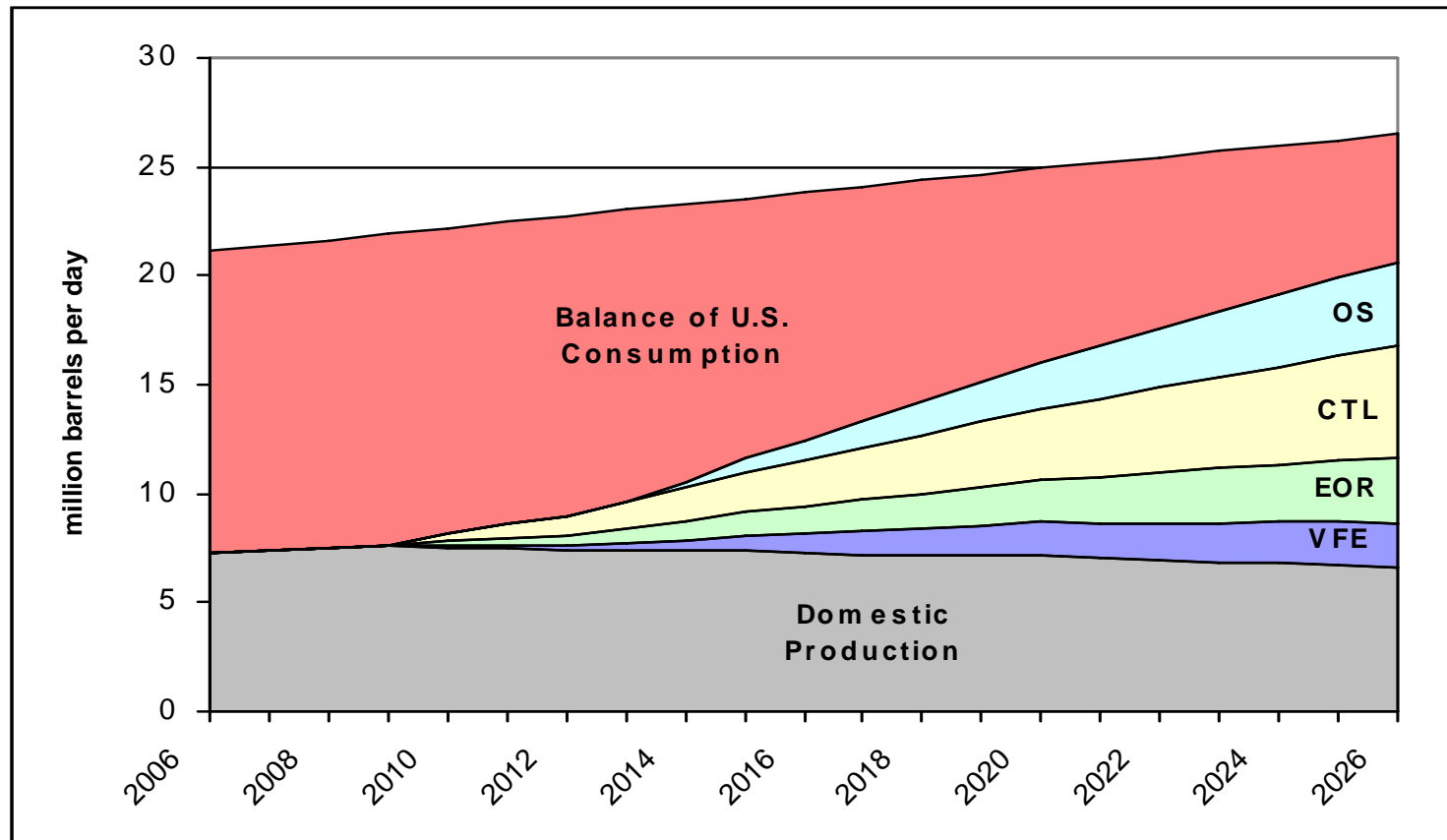


U.S. Crash Program to Cut Imports



Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

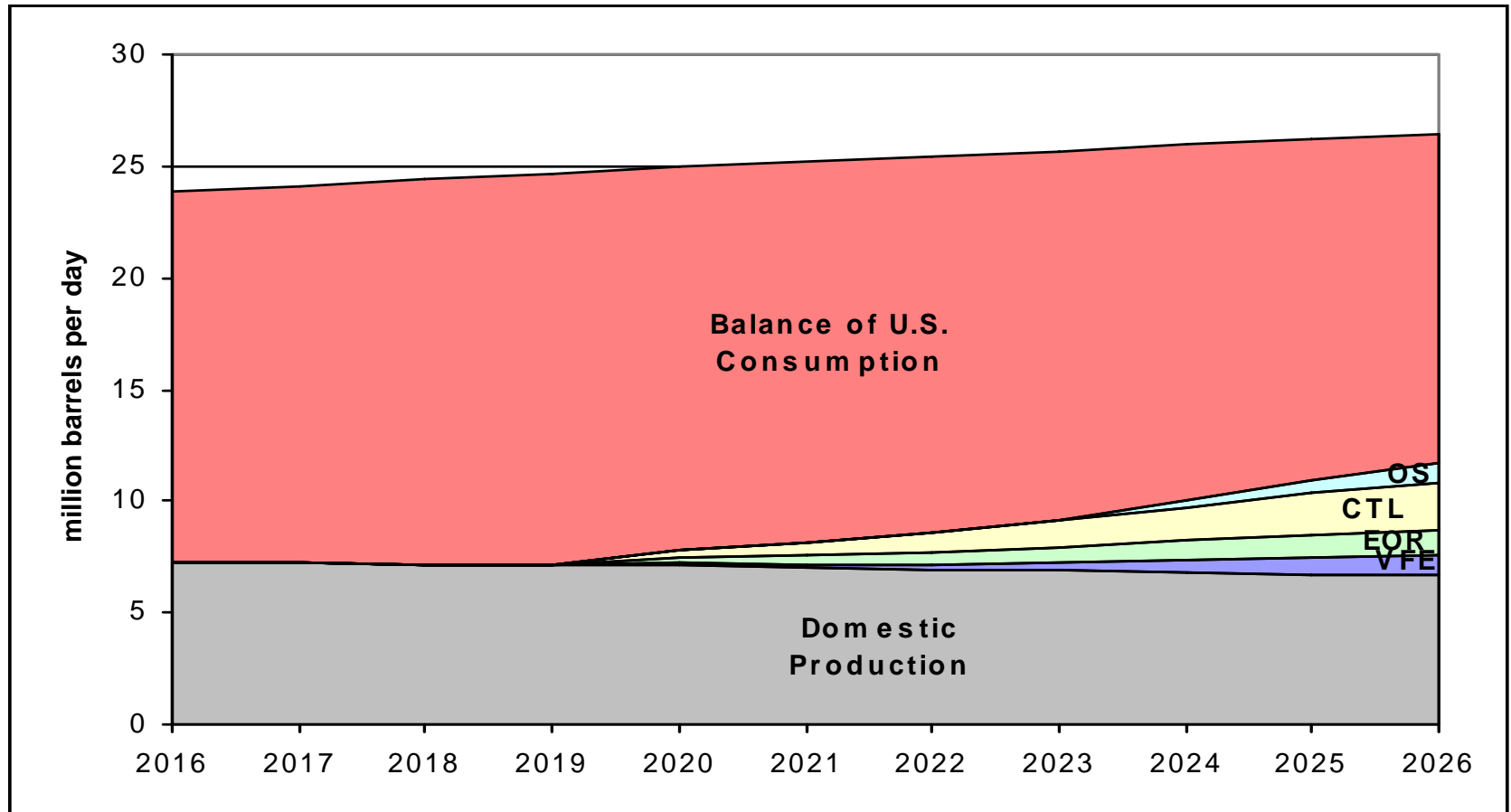
Mitigation Impacts if Initiated in 2006 (forecasts based on EIA projections)



Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

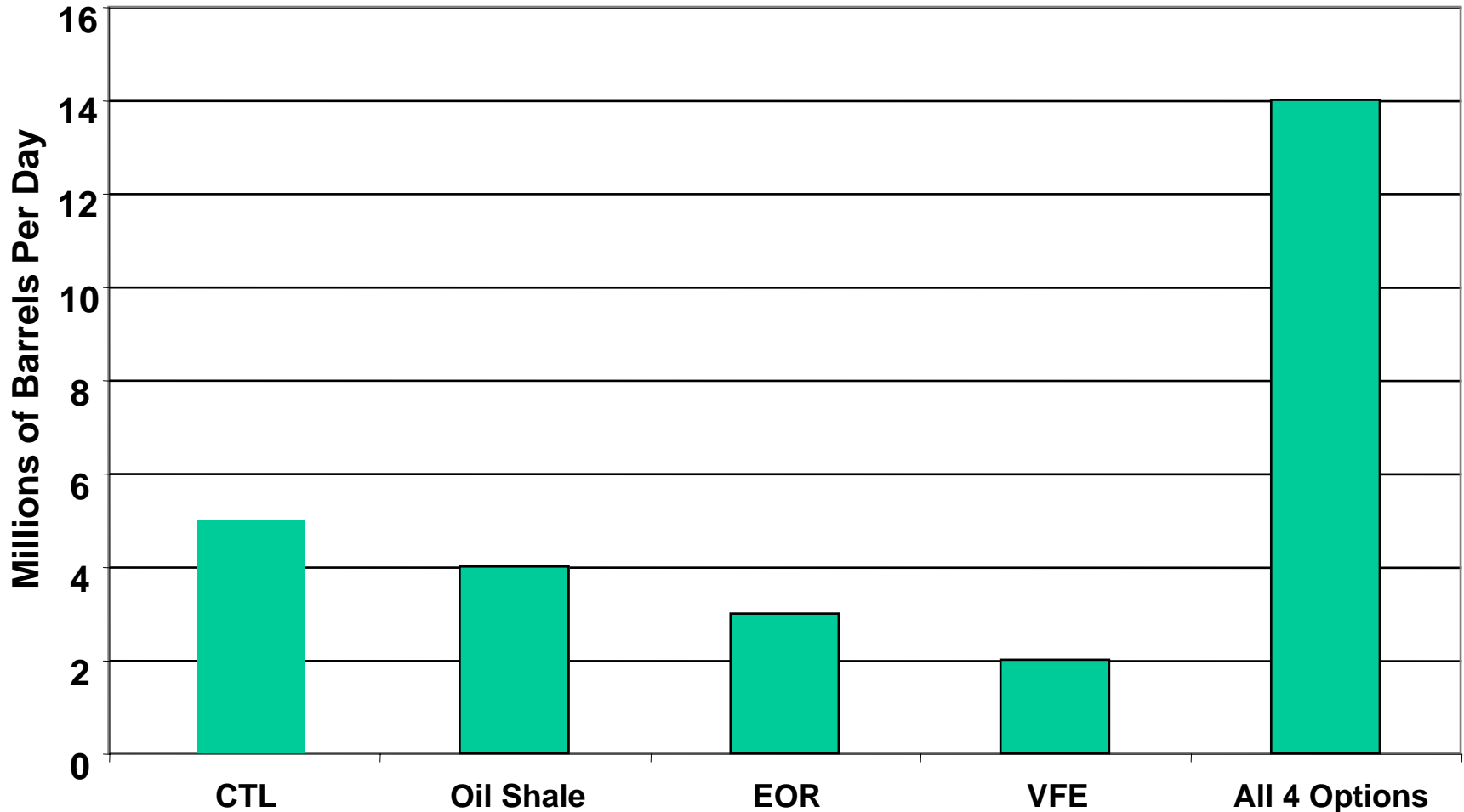
Mitigation Impacts if Initiated in 2016

(forecasts based on EIA projections)



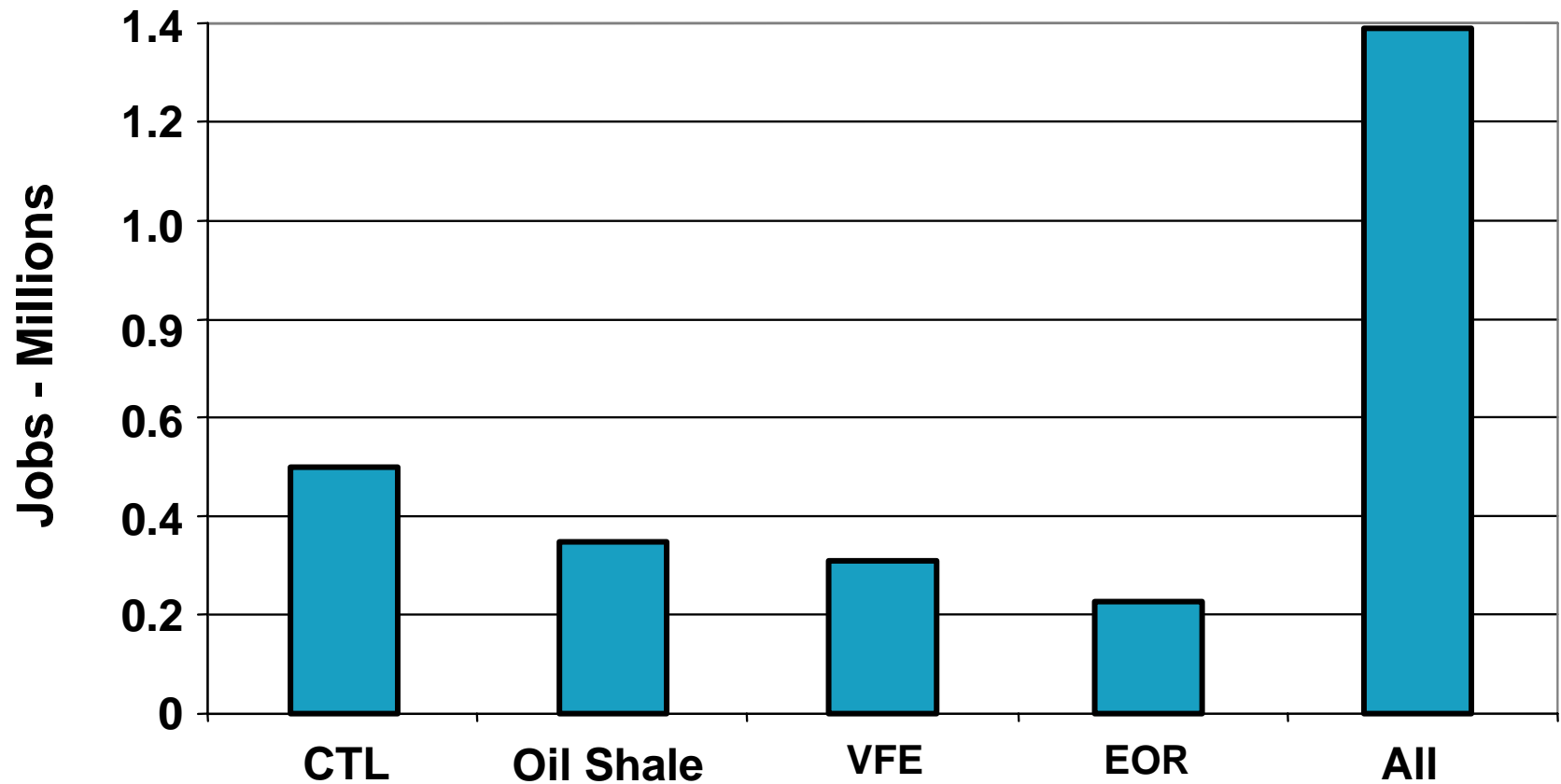
Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

Contributions After 20 Years of Crash Programs



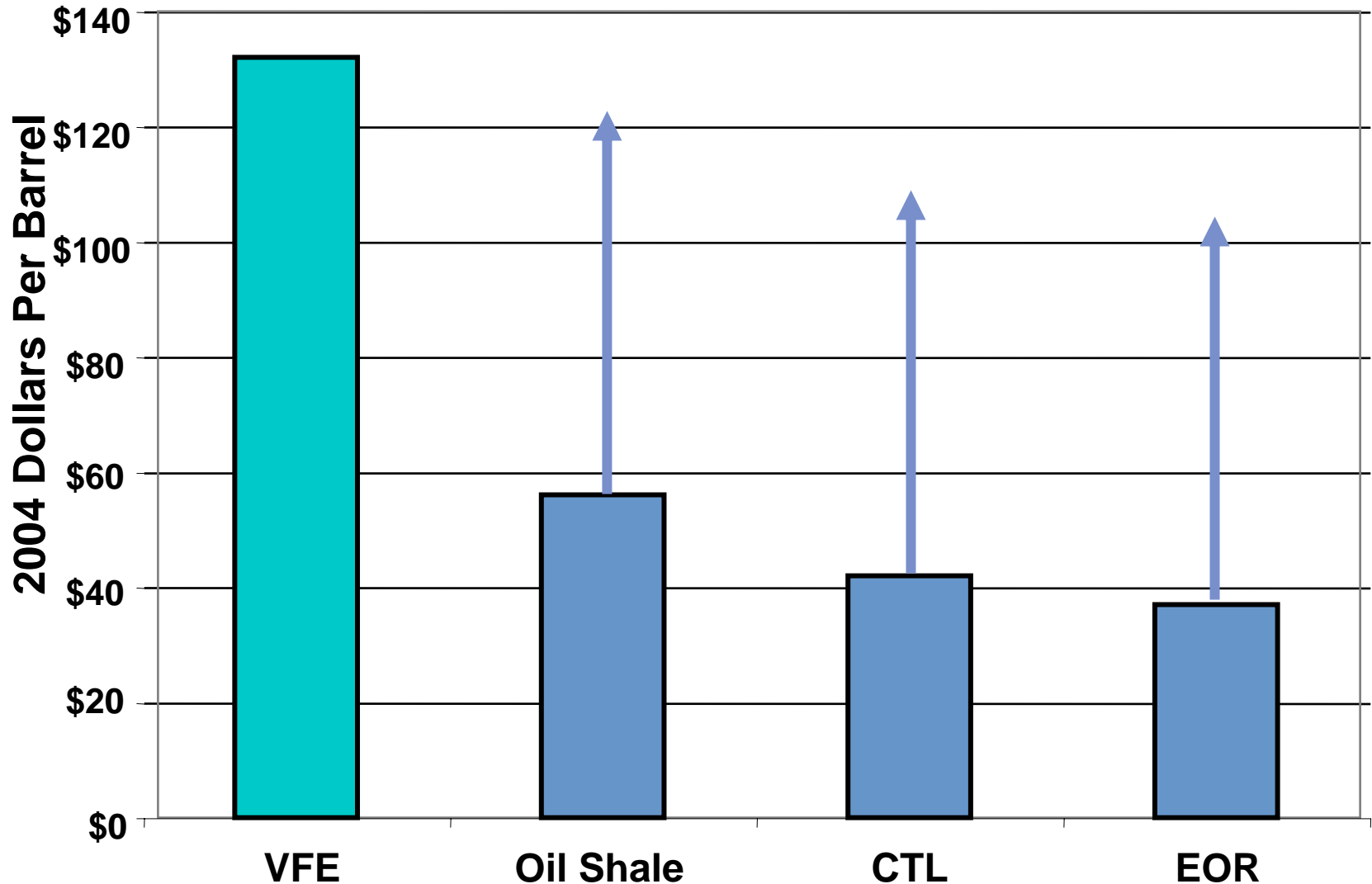
Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

Jobs Created Annually in Year $t_0 + 20$



Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

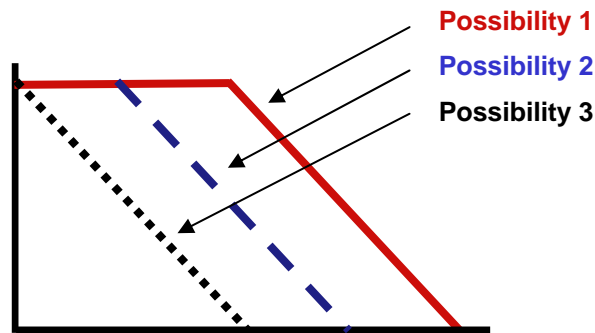
Cost of Each Mitigation Technology



Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

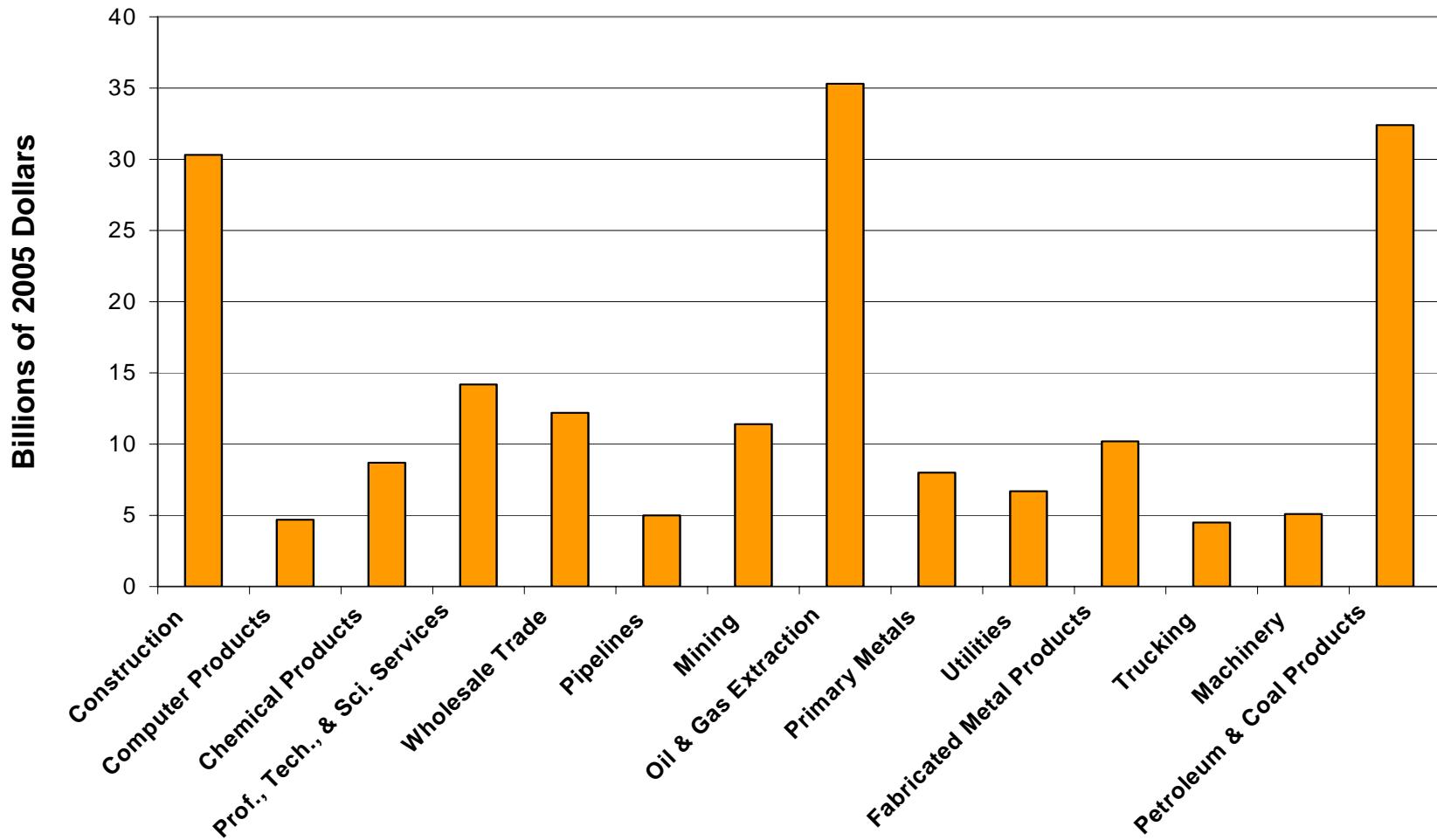
Crash Programs Will Escalate Liquid Fuel Production Costs

U.S. 20 year capital costs based on N^{th} plants = \$2.6 trillion



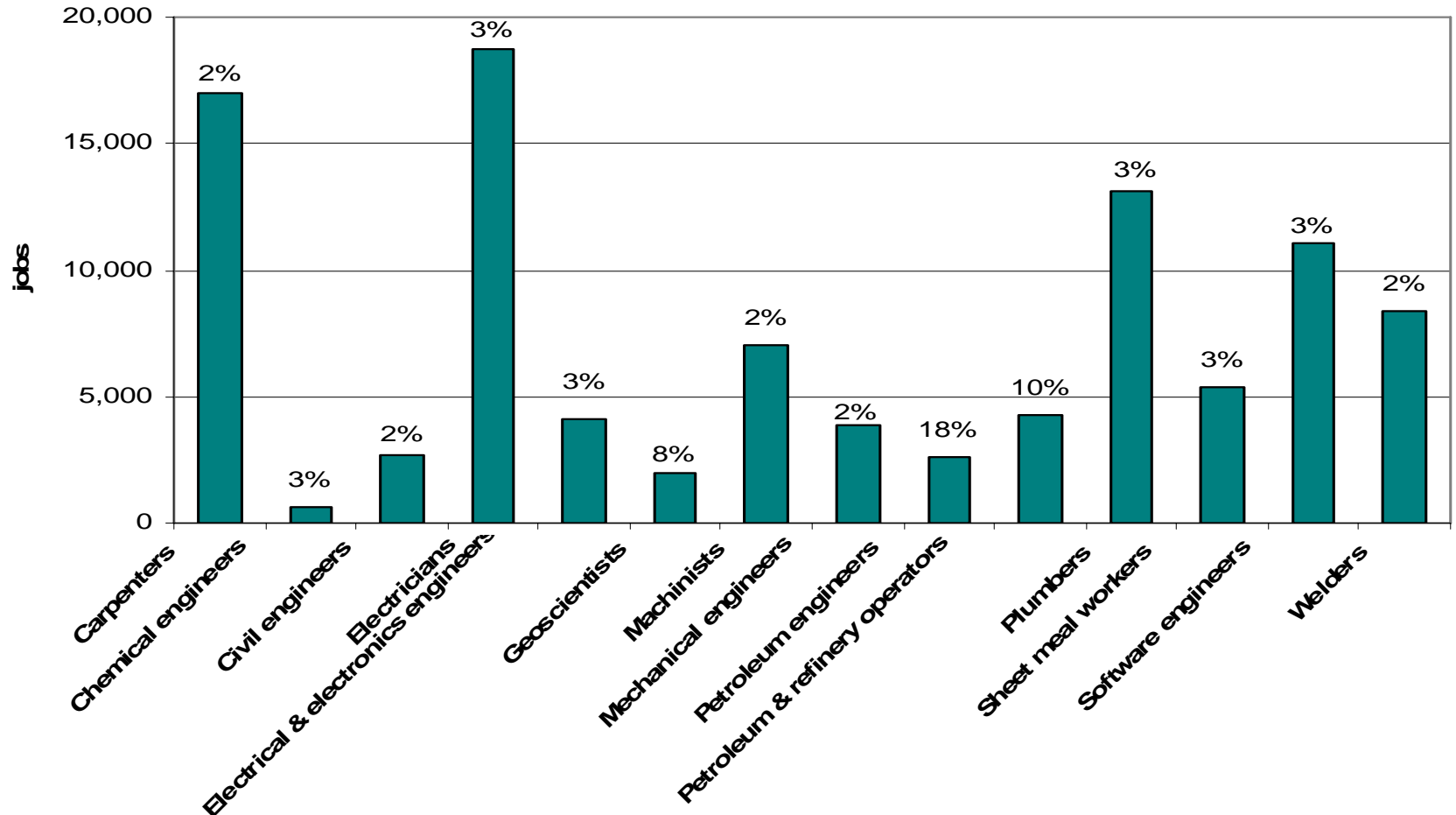
\$4 - 6 Trillion Cost (20 years)
Likely Due to Cost Escalation

The Mitigation Initiatives Will Create \$100's of Billions of Sales For Industries



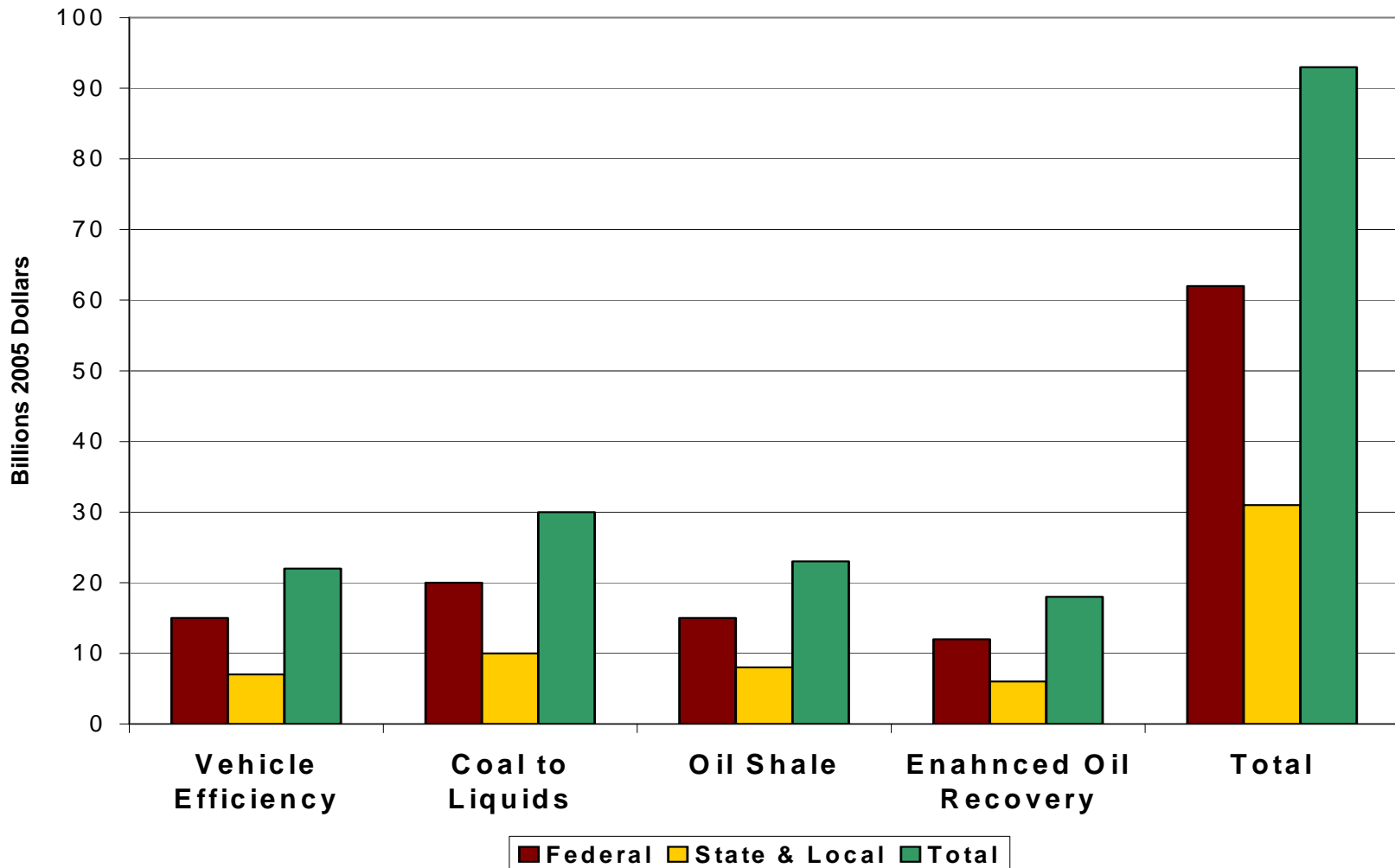
Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

Occupational Jobs Created by the Mitigation Options



Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

The Mitigation Initiatives Will Create Billions of Tax Revenues



Source: Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch, *Economic Impacts of U.S. Liquid Fuel Mitigation Options*, DOE/NETL-2006/1237, July 8, 2006.

Benefits to a State of a Small (30,000 Barrels/Day) Coal Liquefaction Plant

- Development & construction expenditures: \$2.5 billion
- Annual O&M expenditures: \$400 million
- Direct development & construction jobs: 2,000 +
- Development & construction payroll: \$100 million
- Annual direct O&M jobs: 400
- Annual O&M payroll: \$25 million
- Total new jobs annually: 1,000+
- Annual state & local govt. tax revenues: \$10 - \$20 million

Findings (1)

- Mitigation options can contribute significantly to saving and production of U.S liquid fuels
- It will take decades for significant impact
- Costs will be in the trillions of dollar range

Cumulative 20 year impact would be:

- Savings and production of 44 billion barrels of liquid fuels
- Requirement for over \$2.6 trillion of investment (minimum estimate)
- Over 10 million employment years of jobs created
- Total industry sales of over \$3 trillion occurred
- Over \$125 billion of industry profits accrued
- Over \$500 billion in federal government tax revenues accrued
- Nearly \$300 billion in state & local government tax revenues

Findings (2)

U.S. is endowed with needed geological resources, capital, labor, and management to undertake such an effort

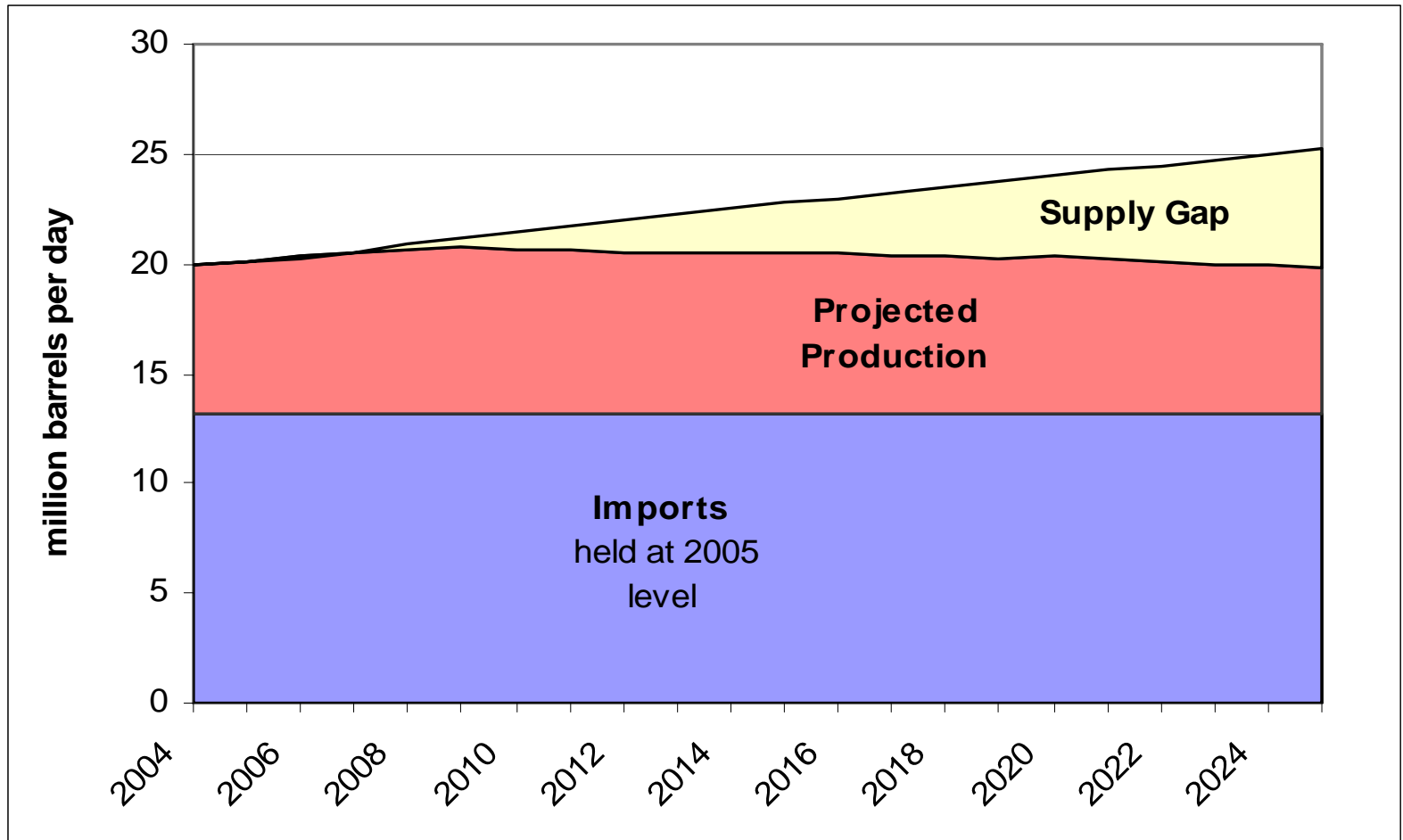
Aggressive mitigation programs would have substantial benefits for U.S.:

- Enhanced energy security
- Trillions of dollars of industry investment and sales
- Hundreds of billions of dollars of industry profits
- Rejuvenation of many U.S. manufacturing industries
- Hundreds of billions of dollars of tax revenues
- Millions of jobs
- Elimination of most U.S. oil imports

PRES. BUSH: “REDUCE OIL IMPORT DEPENDENCE”

FIRST THING TO DO: STOP DIGGING!

(forecasts based on EIA projections)



If crash mitigation programs were initiated in 2006, it may be possible to stabilize U.S. oil imports by 2016

Mitigation options may reduce the total level of U.S. imports from current 13 mbpd to:

- 12 mbpd in 2016
- 6 mbpd in 2025

However, this **depends on crash mitigation being started in 2006**. **If delayed, oil import gap may not be closed for two decades**. If implementation is delayed until 2011, mitigation options may change total level of U.S. imports from current 13 mbpd to:

- 15 mbpd in 2016
- 12 mbpd in 2025

Thus, U.S. oil imports would increase from the current 13 mbpd and may not be reduced below that level until about 2025.

Interpretation of Study Findings

Controversy over interpretation; **findings have various implications for ASPO and others:**

- Costs and benefits of liquid fuel requirements
- What is required to maintain “current energy regime”
- Implications of maintaining “current energy regime”
- What is required to change “current energy regime”
- Time & \$ required to transition to a “new energy regime”

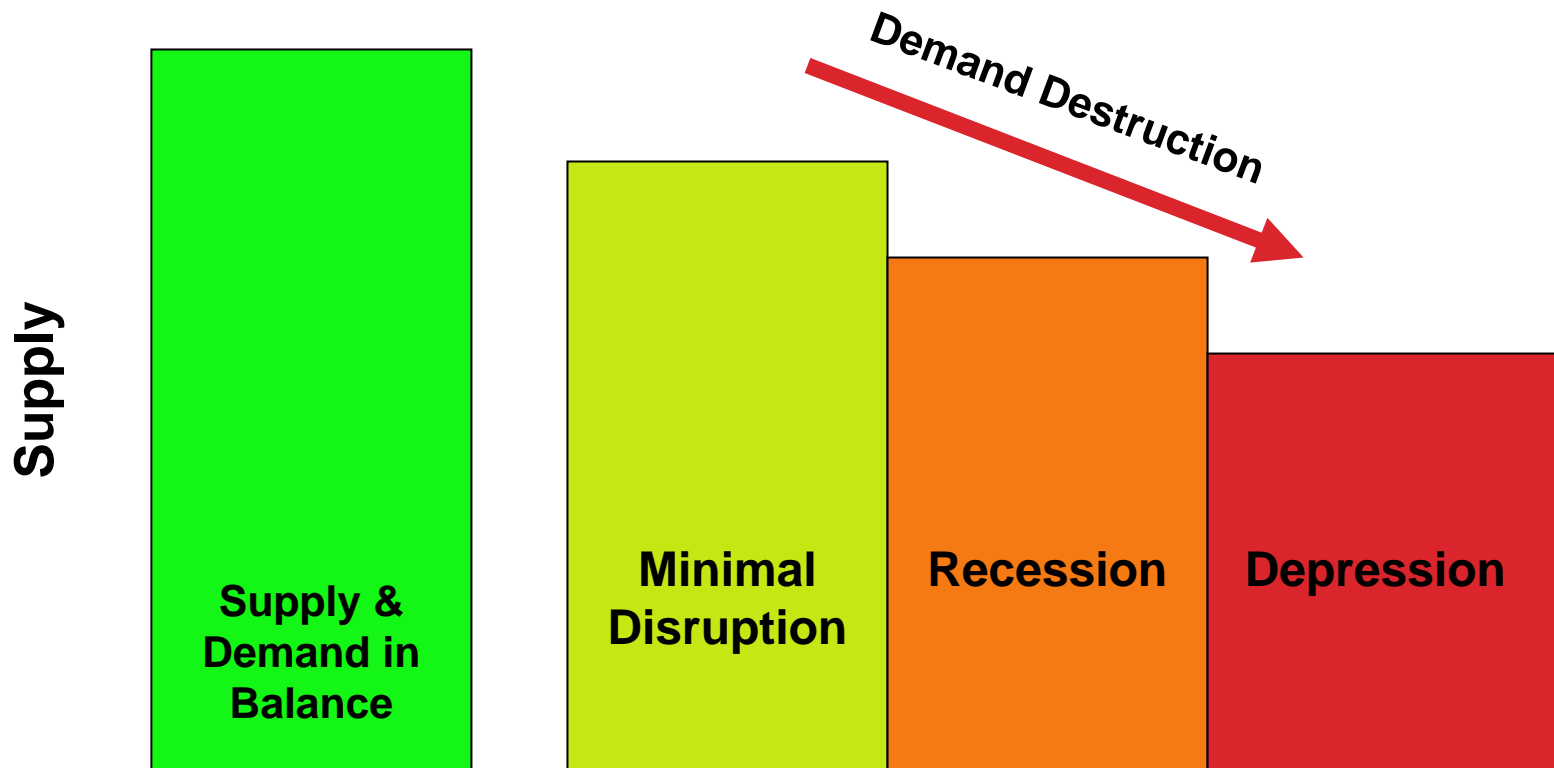
How to get from “here” to “there – the new energy regime?”

What is “there”? When is there: 2020? 2025? 2030?

Major finding: Problem is of enormous scale, will require decades to resolve, and will require \$ trillions investment.

No easy, “painless” solution

Growing Oil Shortages Will Induce Growing World “Demand Destruction”



What About “Demand Destruction”

- Is demand destruction the solution or the problem?
- It is always the “default solution:” Absent mitigation options, it will always equate oil supply with demand
- However, demand destruction is an euphemism for recession, depression, mass unemployment, etc.
- People – & governments – will not passively accept massive demand destruction and may opt for desperate alternatives
- Therefore, objective should be to use mitigation options to minimize and control demand destruction

Peak Oil Progress in the U.S.

It's a start

- President Bush: U.S. is “addicted to oil” & must reduce oil imports
- Studies and plans being developed by Federal agencies: Dept. of Energy, Dept. of Defense, Unconventional Fuels Task Force, DOE labs
- Studies and plans being developed by state governments, SSEB, Western Governors Association, other groups
- Many states have passed alternate fuel legislation & are issuing mandates & building plants
- U.S. Congress: Study mandated for GAO, Congressional Caucus formed, incentives legislation passed
- Independent initiatives: National Academy of Sciences, National Coal Council, National Petroleum Council

Concluding Remarks

- **Earlier (2005) world peak oil mitigation study has provided estimates and guidance**
- **Experience: Peaking could come with little warning & sharp declines.**
- **The new U.S.-only study provides time, cost, industry, job, & skill estimates: Scale is enormous & poorly recognized.**
- **Definition of “Peak Oil” needs to be clarified – some analysts keep expanding the definition of “oil.”**
- **The U.S. Energy Secretary has talked of peak oil, & some U.S. government activities are underway. It’s a start.**

THREE POLICY RECOMMENDATIONS

1. The **federal government** should increase vehicle fuel efficiency standards and initiate substitute liquid fuels mitigation options.
2. **State and local governments** should encourage smart growth, telecommuting, mass transit, and other transportation fuel efficiency options and facilitate and expedite the siting of substitute liquid fuels plants.
3. **All levels of government** should educate the public to the fact that we face a serious liquid fuels problem that will require controversial and unpopular measures to reduce demand and increase supply.



It might happen again!