

# Winning the Oil Endgame

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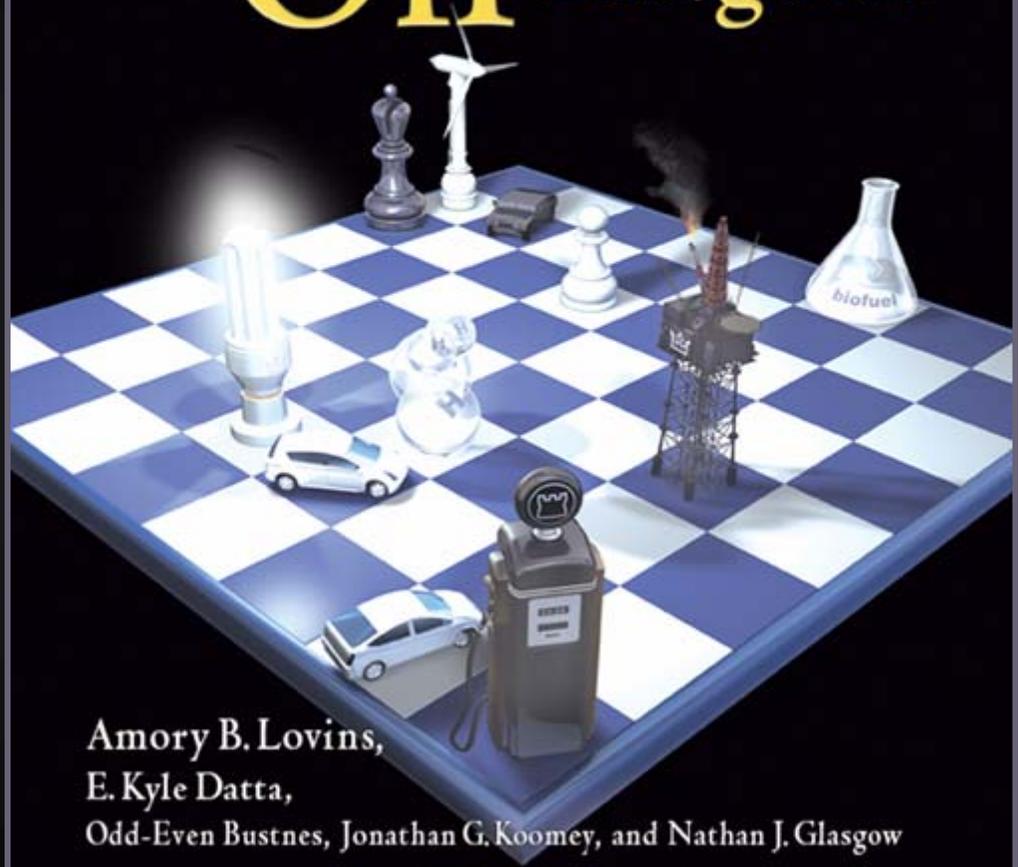
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# Winning the Oil Endgame

Innovation for Profits,  
Jobs, and Security



Amory B. Lovins,  
E. Kyle Datta,  
Odd-Even Bustnes, Jonathan G. Koomey, and Nathan J. Glasgow

*Forewords by George P. Shultz and  
Sir Mark Moody-Stuart*

Book and technical  
backup are free at:  
[www.oilendgame.com](http://www.oilendgame.com)

# What's the problem?



# The U.S. oil problem in a nutshell

- ▶ Americans use 26%, produce 9%, and own 2–3% of the world's oil...so we can't drill our way out
- ▶ Fungible in world market; issue is use, not imports
- ▶ The next barrel is cheaper abroad than at home
- ▶ Security is an issue at 70% import dependence, with Saudi Arabia as the only significant swing producer
- ▶ Three basic approaches to oil strategy
  - Ostrich
  - Conventional supply emphasis
  - Substitute, innovate and revitalize — cheaper, safer, surer; our focus

POLITICS & POLICY

# Unlikely Allies Fight U.S. Oil Dependence

*Bipartisan Network to Press for Reduced Consumption, Quicker Development of New Fuels*

\$3.90 U.S. • \$4.50 Canada

**The Ripon Forum**

**OIL: OUR FATAL DEPENDENCE**

INSIDE: The Politics of Abortion • Why Iraq Matters  
Can Republicans be Green? • Disconnected Democrats

www.riponforum.org

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Cover Story

**Ending Our Oil Dependence**

Replacing all the oil the U.S. needs will cost less than buying it

By Robert S. Lyne

Inside Andy Grove's Latest Crusade • Toyota's Secret Weapon

**FORTUNE**

SPECIAL REPORT

**HOW TO KICK THE OIL HABIT**

America's addiction to foreign oil has never seemed more dangerous. It won't be easy to quit. Here's a four-part plan that gives us a big headstart.

WEEKEND

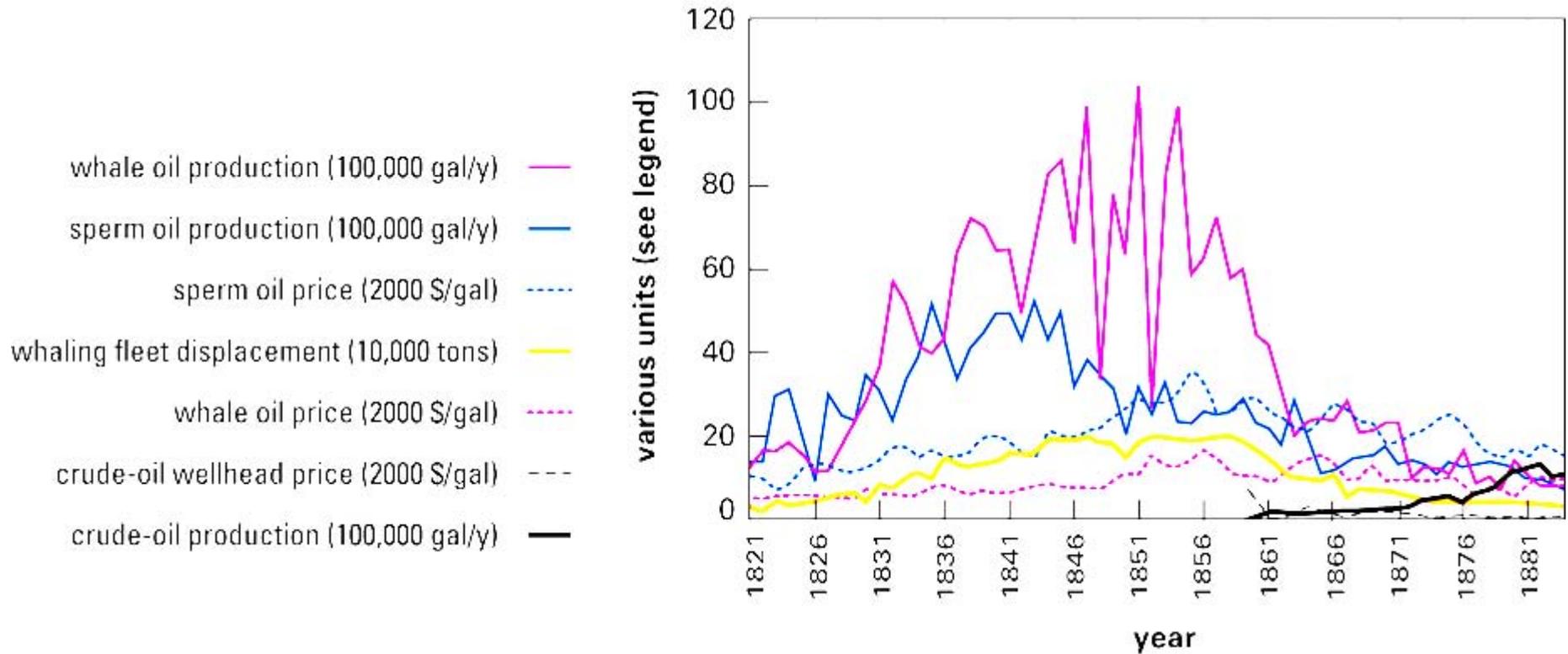
**FINANCIAL TIMES**

4844 | SATURDAY MARCH 12 | SUNDAY MARCH 13 2011

**IEA says world must turn away from oil**

■ Agency says governments should act to cut demand

# Whalers ran out of customers before they ran out of whales...



...even *before* Drake struck oil in 1859!





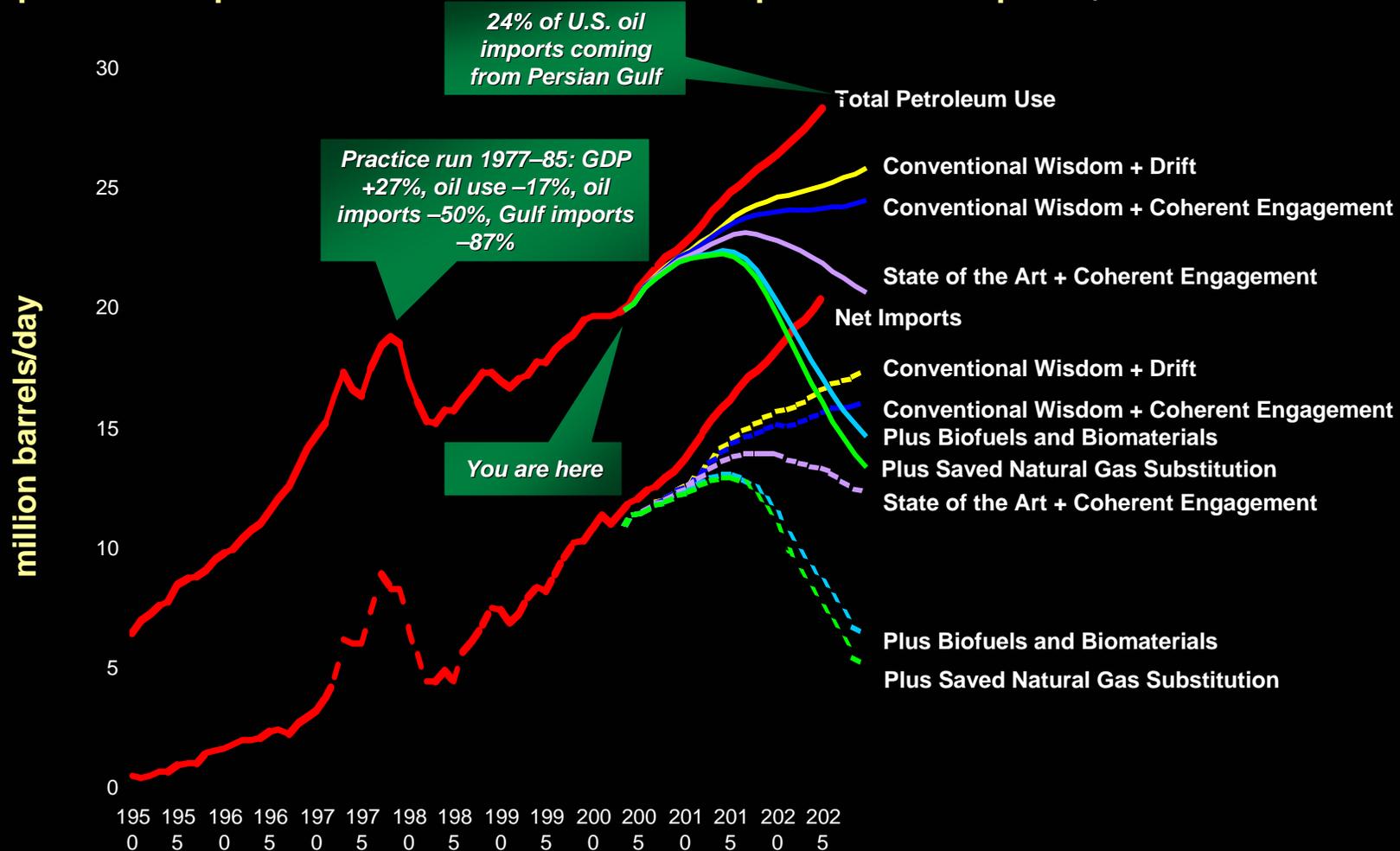
Photo copyright Colani DAF





# Our energy future is choice, not fate

U.S. petroleum product consumption and net petroleum imports, 1950–2025



# Winning the Game: restoring competitiveness *and* eliminating oil dependence

- ▶ National competitiveness and national security at risk

## Why should we care?

- ▶ Japan, EU, China will eat Detroit's jobs for lunch
- ▶ Energy insecurity, price volatility, and climate concerns, perhaps depletion
- ▶ Save net \$70 billion/y by 2025, create 1 million net jobs

## How do we win?

1. Efficient end-use can save half the oil at \$12 a barrel
2. Biofuels substitute for another fourth
3. Saved gas can displace the rest, preferably via hydrogen

# How do we capture this prize?

- ▶ Invest \$90 billion in transportation equipment industries, plus...
- ▶ \$90 billion to build an advanced biofuels industry

- ▶ Business should lead, but...
- ▶ ...needs acceleration, while...
- ▶ ...expanding customer choice and reducing business risks

- ▶ Federal government: lead, follow, or get out of the way

- ▶ Creates 1 *million* good new American jobs (3/4 rural)
- ▶ Preserves 1 million jobs
- ▶ Returns >\$150 billion/year

- ▶ Support, not distort, business logic with new policies...
- ▶ Market-oriented without taxes
- ▶ Innovation-driven without mandates
- ▶ Reduce federal deficit
- ▶ Broad political appeal

- ▶ Needs little or no Congressional action
- ▶ Can be administrative, or done by the states

# Challenging a basic assumption in Detroit and Washington

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

- ◇ Efficiency assumed to be a tradeoff against price, size, performance, safety,...
- ◇ Hence policy intervention needed to induce customers to buy the compromised vehicles

# How many people still buy phonograph records?

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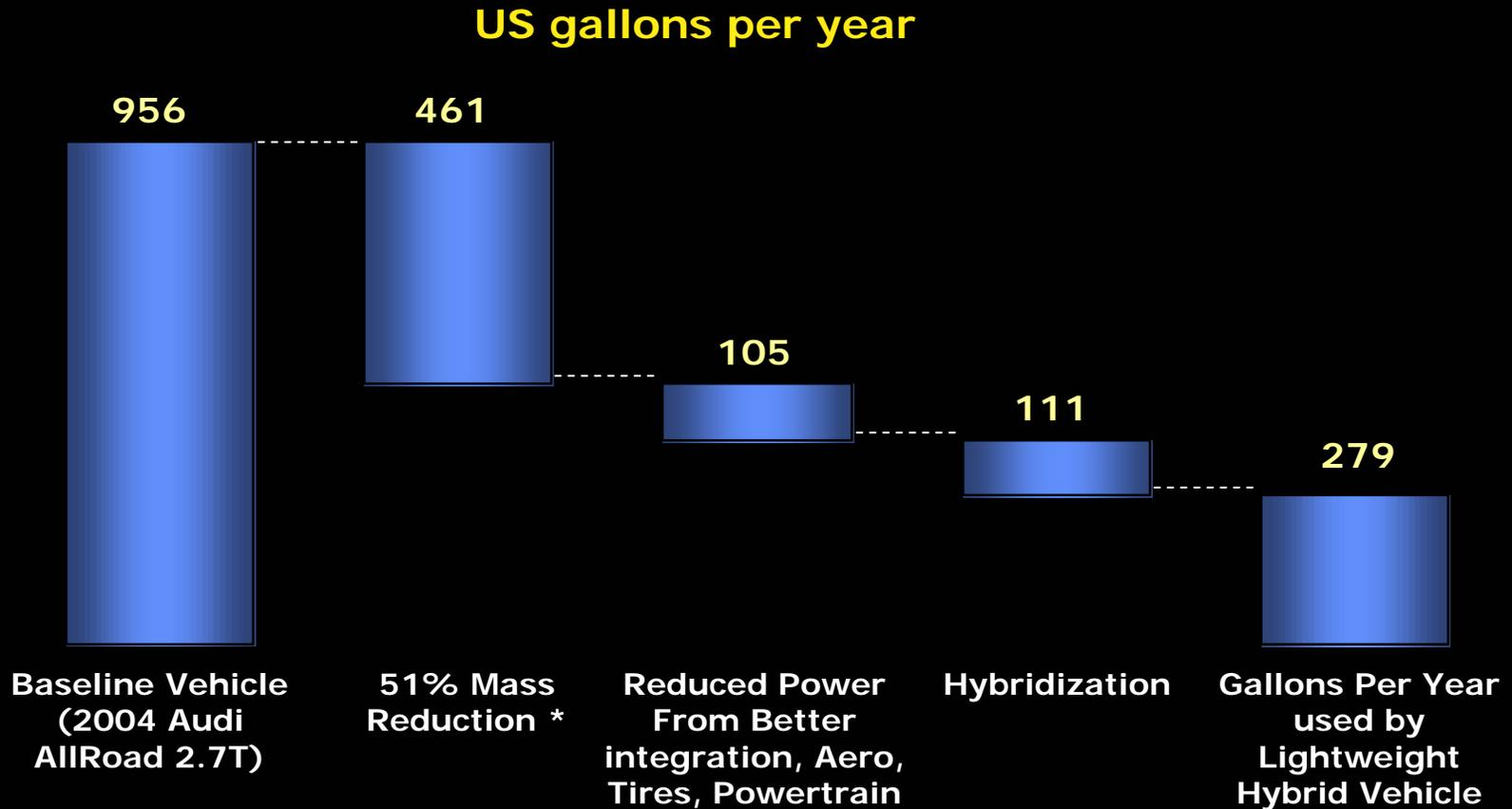
# Where does a car's gasoline go?

13% tractive load



- 6% accelerates the car, <1% moves the driver
- Three-fourths of the fuel use is weight-related
- Each unit of energy saved at the wheels saves ~7–8 units of gasoline in the tank (or ~3–4 with a hybrid)
- **So first make the car much lighter! (safer, ~free)**

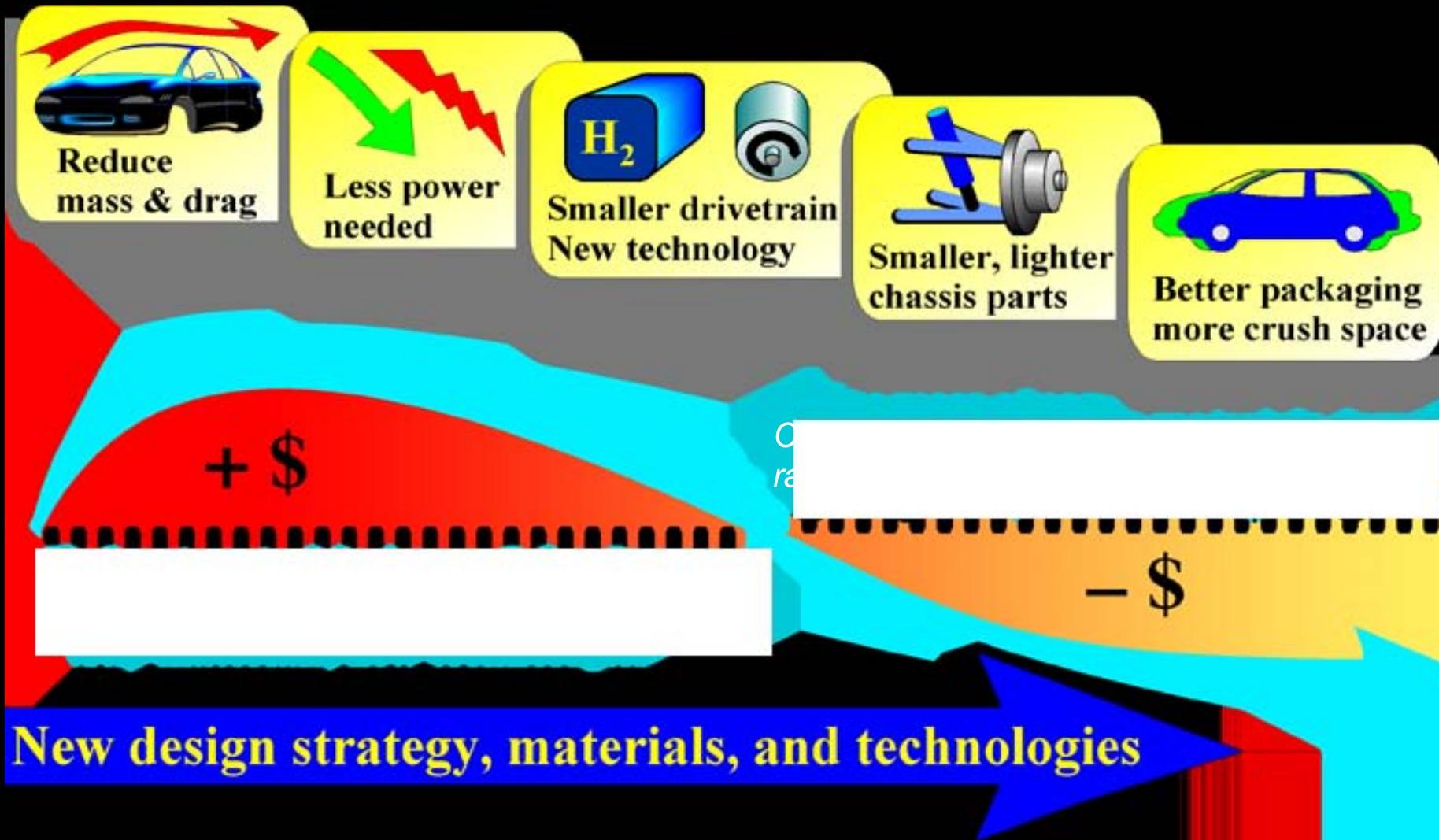
# Critical insight: light weight *before* aerodynamics and powertrain



Issues: crashworthiness and manufacturing cost



# Decompounding mass and complexity also decompounds cost



# Today's concept vehicles will become main-stream



CARS: save 69% at 57¢/gal



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TRUCKS: save 25% free, or 65% @ 25¢/gal

PLANES: save 20% now (787), 45% @ 46¢/gal



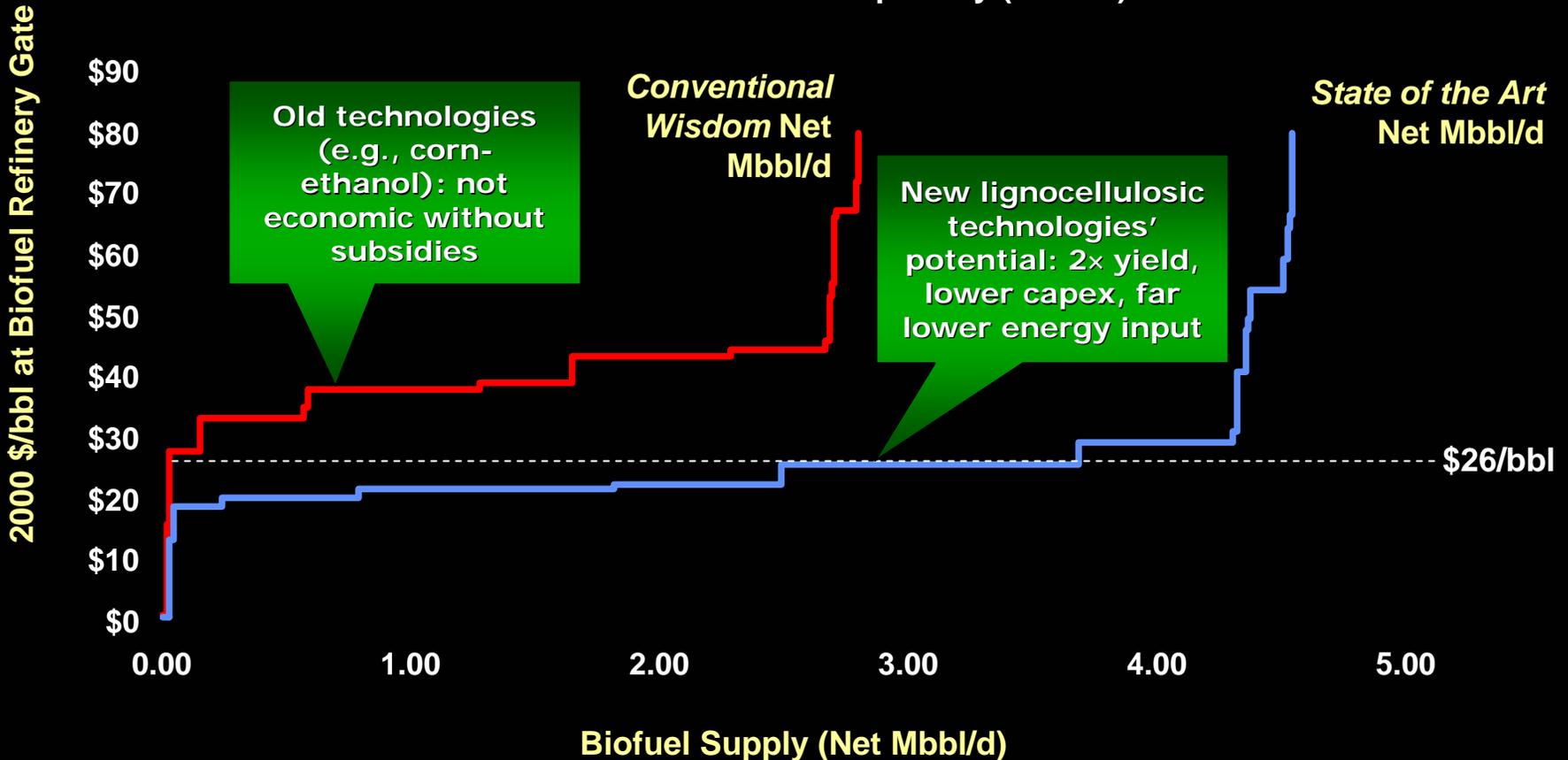
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BLDGS/IND: big, cheap savings; often *lower capex*



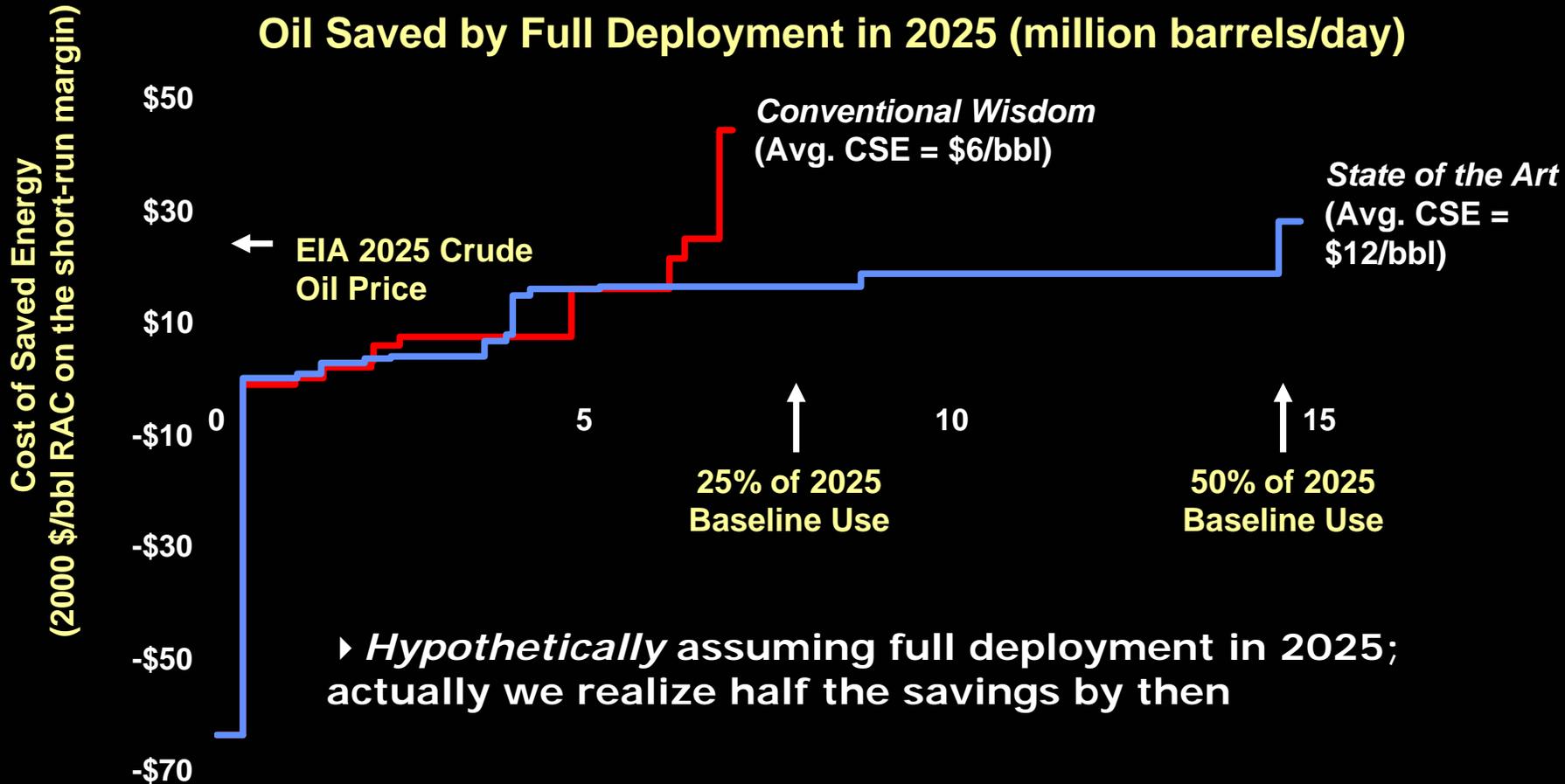
# New biofuel technologies could provide 3.7 Mbb/d cheaper than oil—without subsidies

Biofuels Substitution Supply Curve  
Net million barrels per day (Mbb/d)



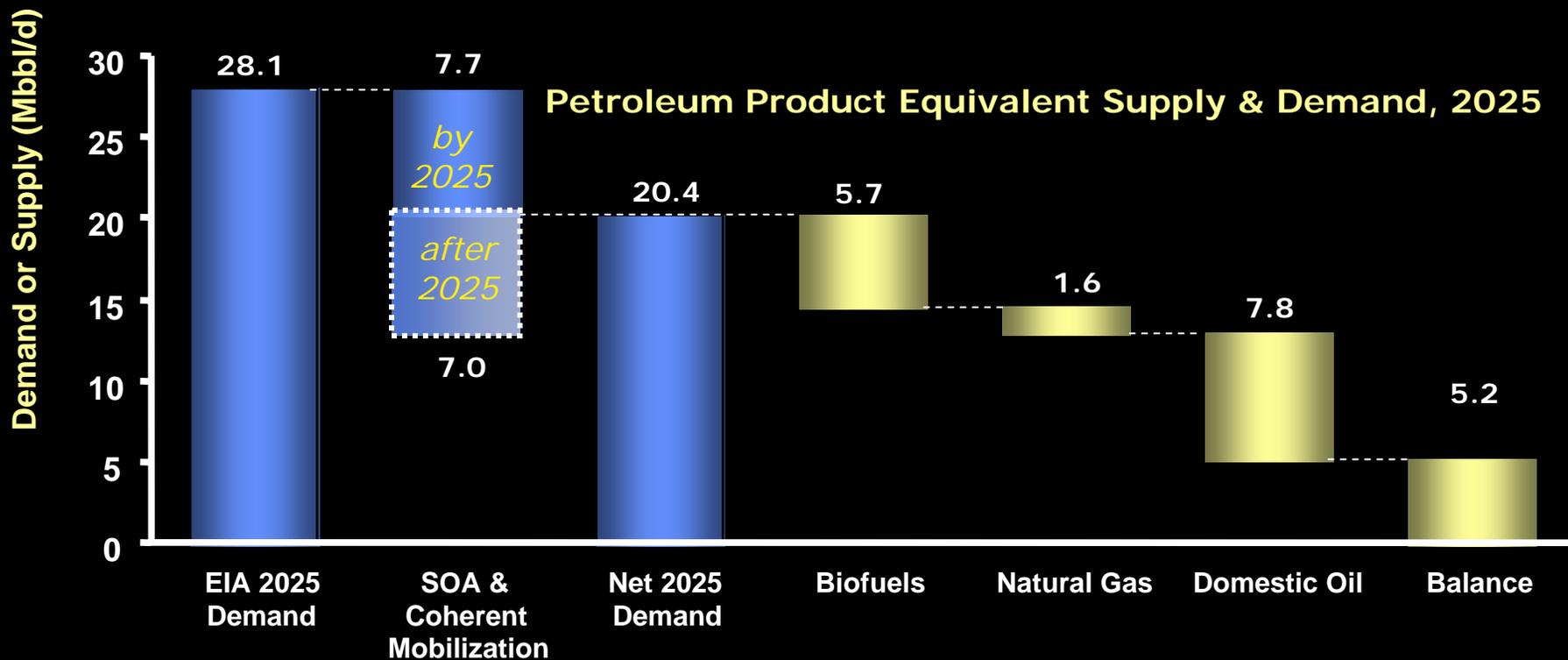
+ 1 Mbb/d in biomaterials/biolubricants

# It pays to be bold



Although *CW* technologies can save 26% of oil use cheaply (\$6/bbl), *State of the Art* technologies can (if fully used) save 52% of 2025 oil for only \$12/bbl

# 2025 demand-supply integration



# What's taking so long?

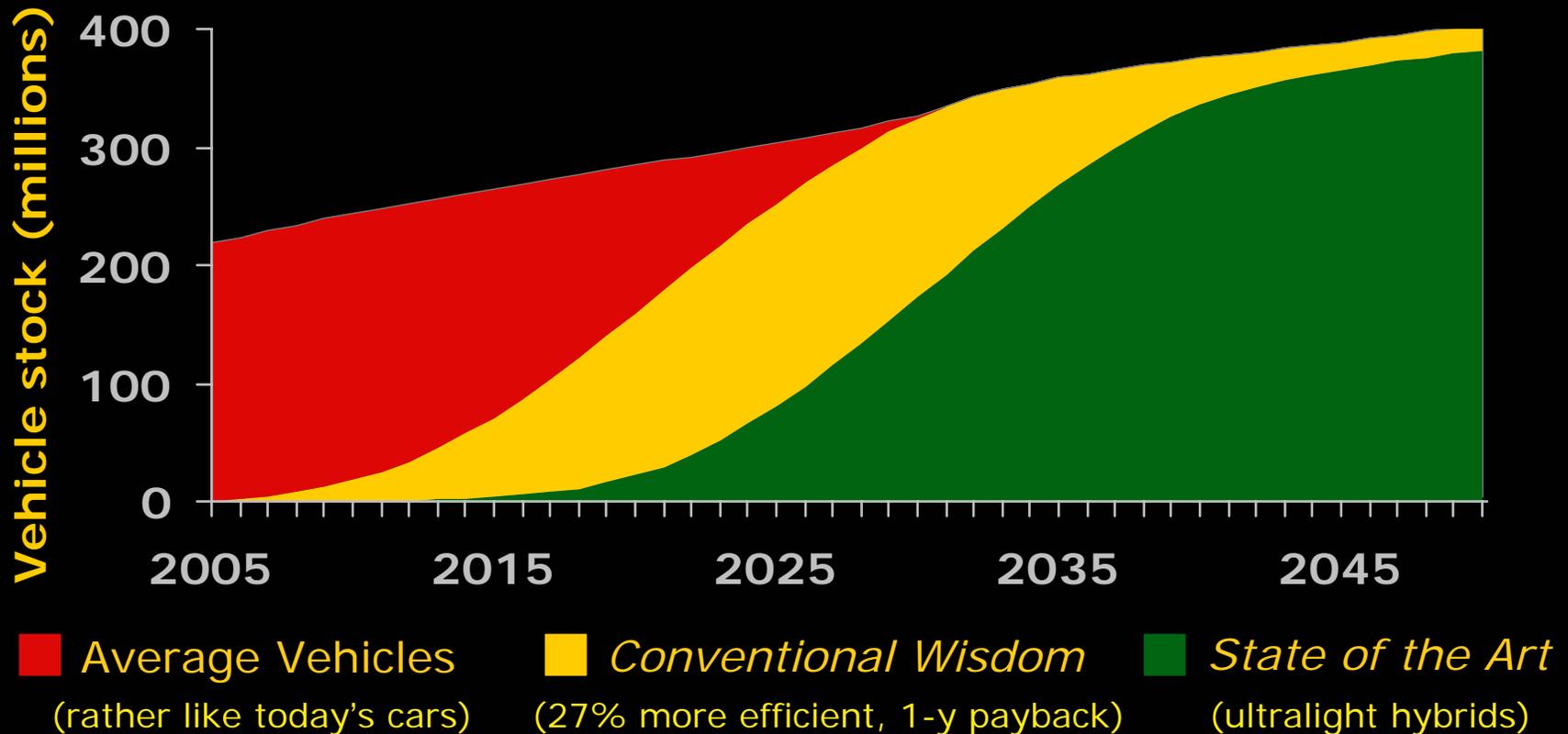
- ◇ Oil is priced below its societal cost
- ◇ Most customers are very short-sighted
- ◇ Most customers have poor information
- ◇ Most managers resist disruptive innovations

# **Four ways government can help**

- 1) Stimulate demand for very efficient vehicles**
- 2) Build vibrant 21<sup>st</sup> Century industries by sharing R&D risk and deploying faster than the private market**
- 3) Lower risk of investment for new manufacturing plants through loan guarantees to automakers**
- 4) Support development of domestic energy supply infrastructure (hydrocarbons → carbohydrates)**

# Mobilization: Accelerating Change

4.5 Mbbbl/d saved, \$391 billion in retail fuel savings



# U.S. Consumers want uncompromised efficiency

(better cars, better fuels, more choices)

- ◇ U.S. consumers want both their choice of vehicle type, but with greater efficiency
- ◇ Hybrids are the fastest growing, best selling vehicles in the U.S., far surpassing expectations



# Military fuel efficiency & advanced materials: keys to warfighting capability & lower cost

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- ▶ Efficiency dramatically improves warfighting **capability**
- ▶ Moving fuel dominates military **logistics**
- ▶ **Strategically**, some of our military force is protecting oil in places we may not want to be

# Military fuel efficiency & advanced materials: keys to warfighting capability & lower cost

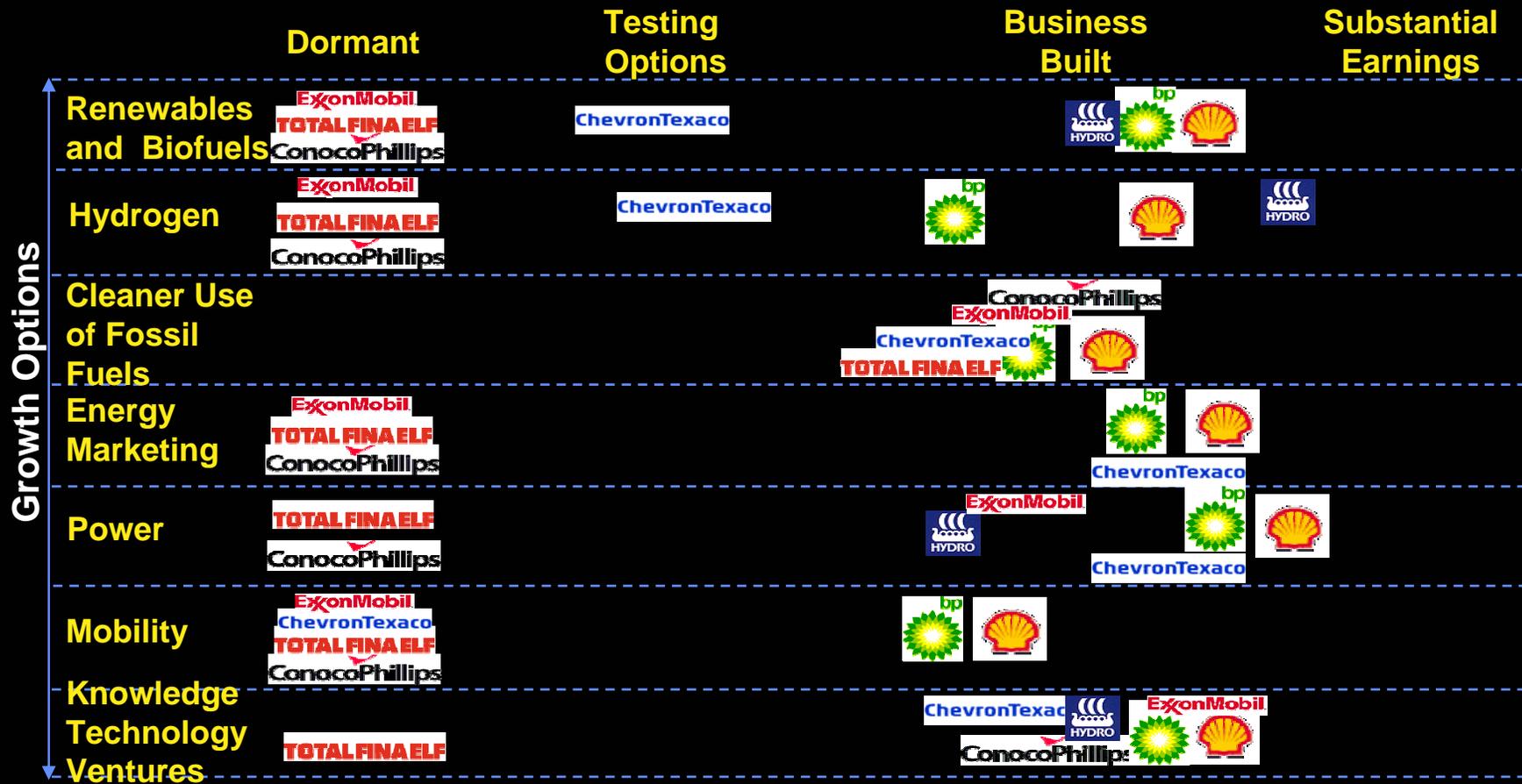
- ▶ Efficiency dramatically improves warfighting capability
- ▶ Requires repeat of semiconductor success: create an advanced materials industrial cluster
  - ▶ Immediate insertion opportunity (2Q05): lightweight composite ballistic panels for up-armoring HMMWVs
- ▶ National Defense Energy Savings Act (fix CBO); reexamine single-fuel doctrine

## 3 areas for military focus:

- ▶ Platform design
  - ▶ Design for superefficiency
- ▶ Shift R&D
  - ▶ Focus on development of advanced materials industrial cluster
- ▶ Diversify fuels
  - ▶ Re-consider single fuel doctrine

# Winners and losers: U.S. oils are underinvested in non-oil growth options

## Growth Options For Oil Companies

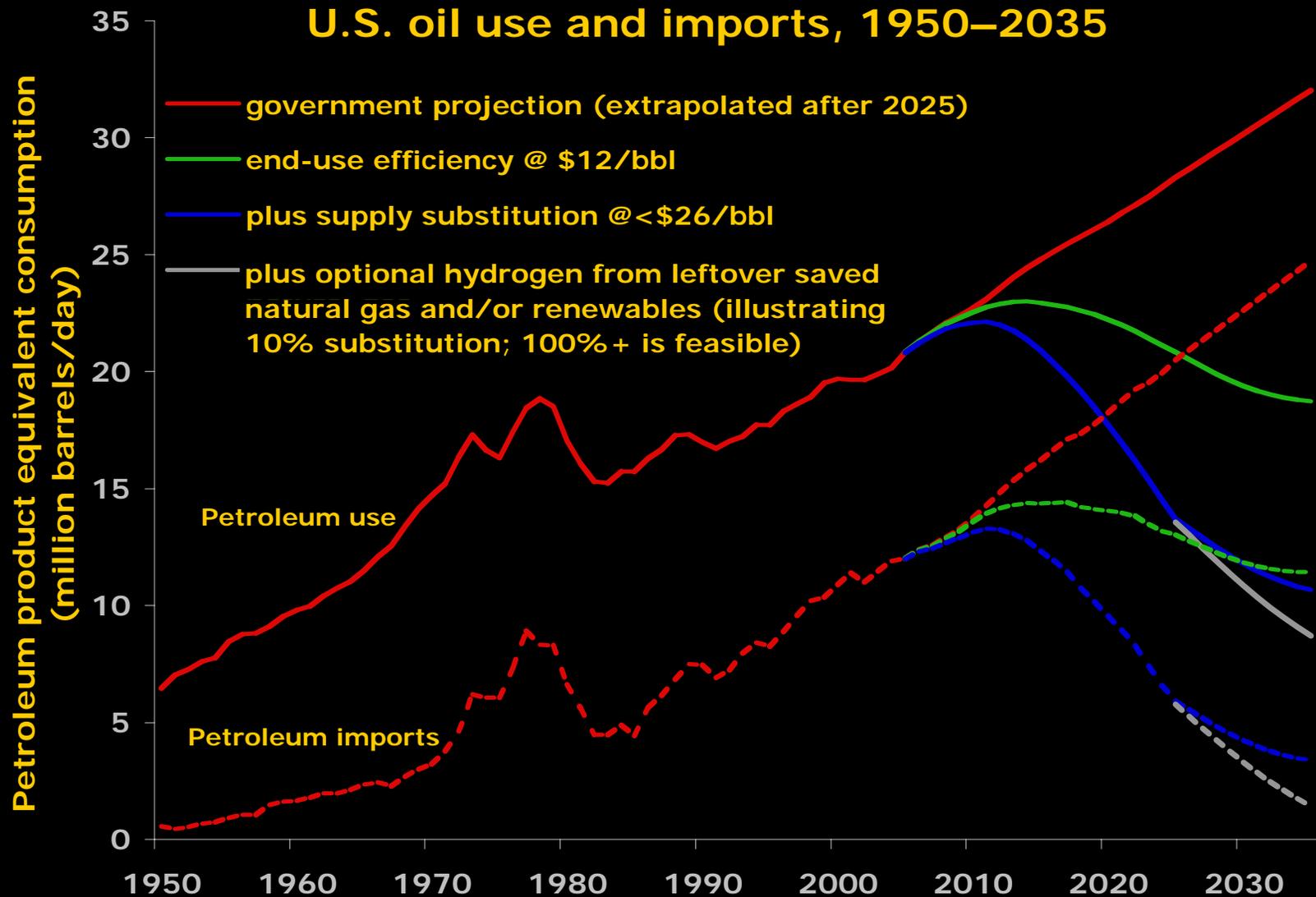


# Big, fast changes have happened

- ◇ U.S. automakers switched in **SIX YEARS** from 85% open wood bodies to 70% closed steel bodies—and in **SIX MONTHS** from making four million light vehicles per year to making the tanks and planes that won World War II



# A profitable U.S. transition beyond oil



# Why should you care enough to act?



[www.rmi.org](http://www.rmi.org)

