

# FreedomCAR & Vehicle Technologies Program



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Energy Efficiency and Renewable Energy

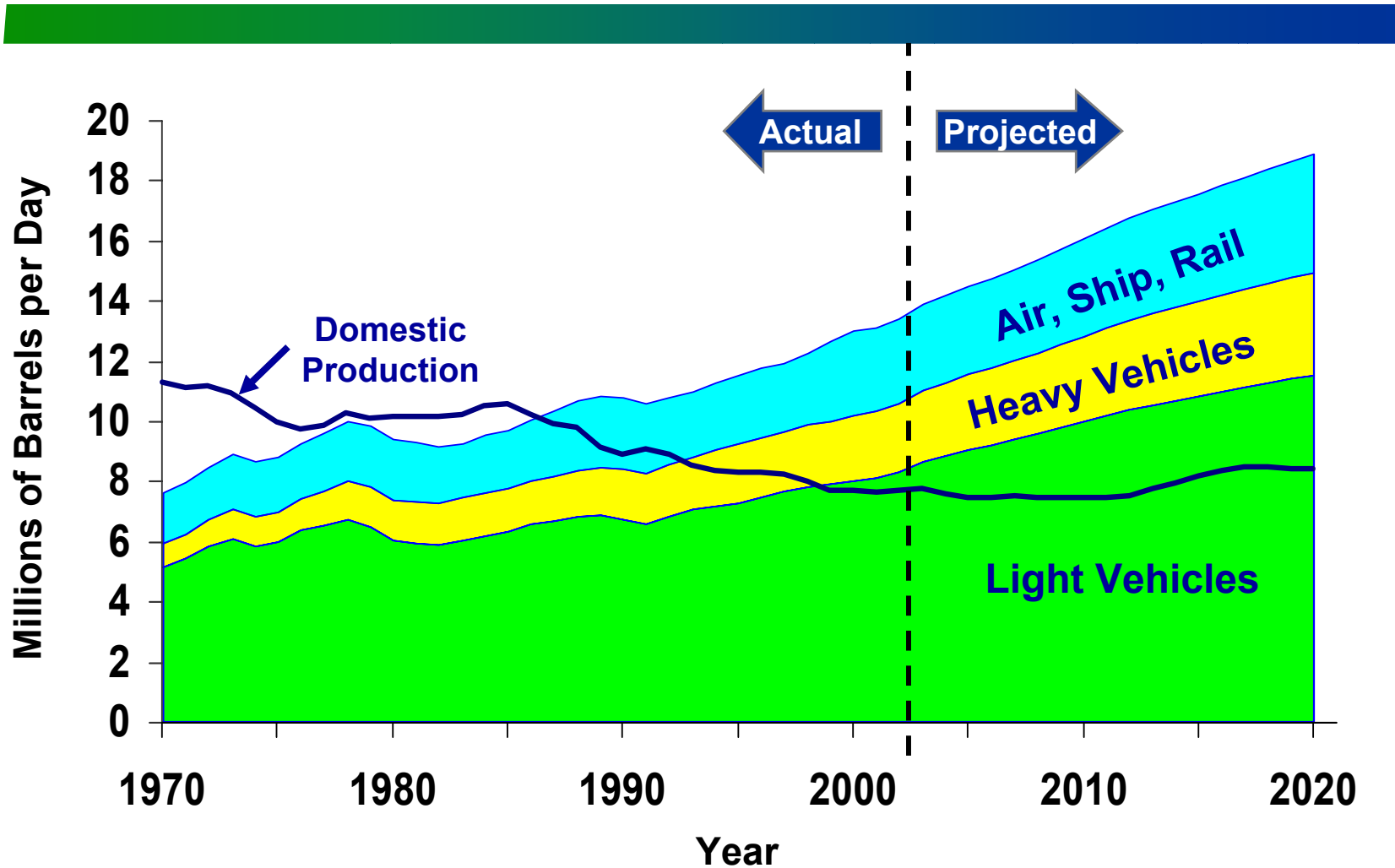


# EERE's Top Nine Priorities

- 1. Dramatically reduce or even end dependence on petroleum**
2. Reduce burden of energy prices on the disadvantaged
3. Increase viability and deployment of renewable energy
4. Increase reliability and efficiency of electricity generation, delivery and use
5. Increase the efficiency of buildings and appliances
6. Increase the efficiency/reduce the energy intensity of industry
7. Create the new domestic bioindustry
8. Lead by example through government's own actions
9. Change the way EERE does business



# U.S. Transportation Demands More Oil





# **Energy Security Through Vehicle Technologies**

## **The Ultimate Vision**

**Affordable, Full-Function Cars and  
Trucks that are Free from  
Petroleum Dependence and  
Harmful Emissions  
Without Sacrificing Mobility, Safety  
and Vehicle Choice**



# Technology Thrusts



<b>Vehicle Systems</b>	<b>Advanced Materials</b>	<b>Fuels Technology</b>	<b>Engine Technology</b>
<ul style="list-style-type: none"><li>• Hybrid Systems</li><li>• Heavy Vehicle Systems</li><li>• Testing &amp; Evaluation</li><li>• Energy Storage</li><li>• Adv. Power Electronics</li></ul>	<ul style="list-style-type: none"><li>• Propulsion Materials</li><li>• Lightweight Materials</li><li>• HTML</li></ul>	<ul style="list-style-type: none"><li>• Adv. Petroleum-Based Fuels</li><li>• Alternative Fuels</li><li>• EPACT Replacement Fuels</li></ul>	<ul style="list-style-type: none"><li>• Combustion &amp; Emissions Control</li><li>• Light Truck Engine</li><li>• Heavy Truck Engine</li><li>• Waste Heat Recovery</li><li>• Off-highway Vehicles</li></ul>

# Advanced Technologies for High Efficiency Clean Vehicles



## Vehicle Systems

- Aerodynamics
- Rolling Resistance
- Accessory Loads
- Systems Analysis and Modeling
- Non-Highway

## Engine Technology

- Combustion R&D
- Emissions Controls
- Clean Combustion & Advanced Engines

## Fuels Technology

- Advanced Petroleum Based Fuels
- Fischer-Tropsch Fuels & Blendstocks
- Non-Petroleum Fuels – Synthetic & Renewable
- Advanced Lubricants

## Hybrid Propulsion

- Hybrid Electric Vehicles
- Electric Vehicles
- Power Electronics
- Batteries (NiMH & Lithium)
- Inverters/Controllers
- Motors
- Ultracapacitors

## Deployment

- EPACT Fleets
- Test & Evaluation

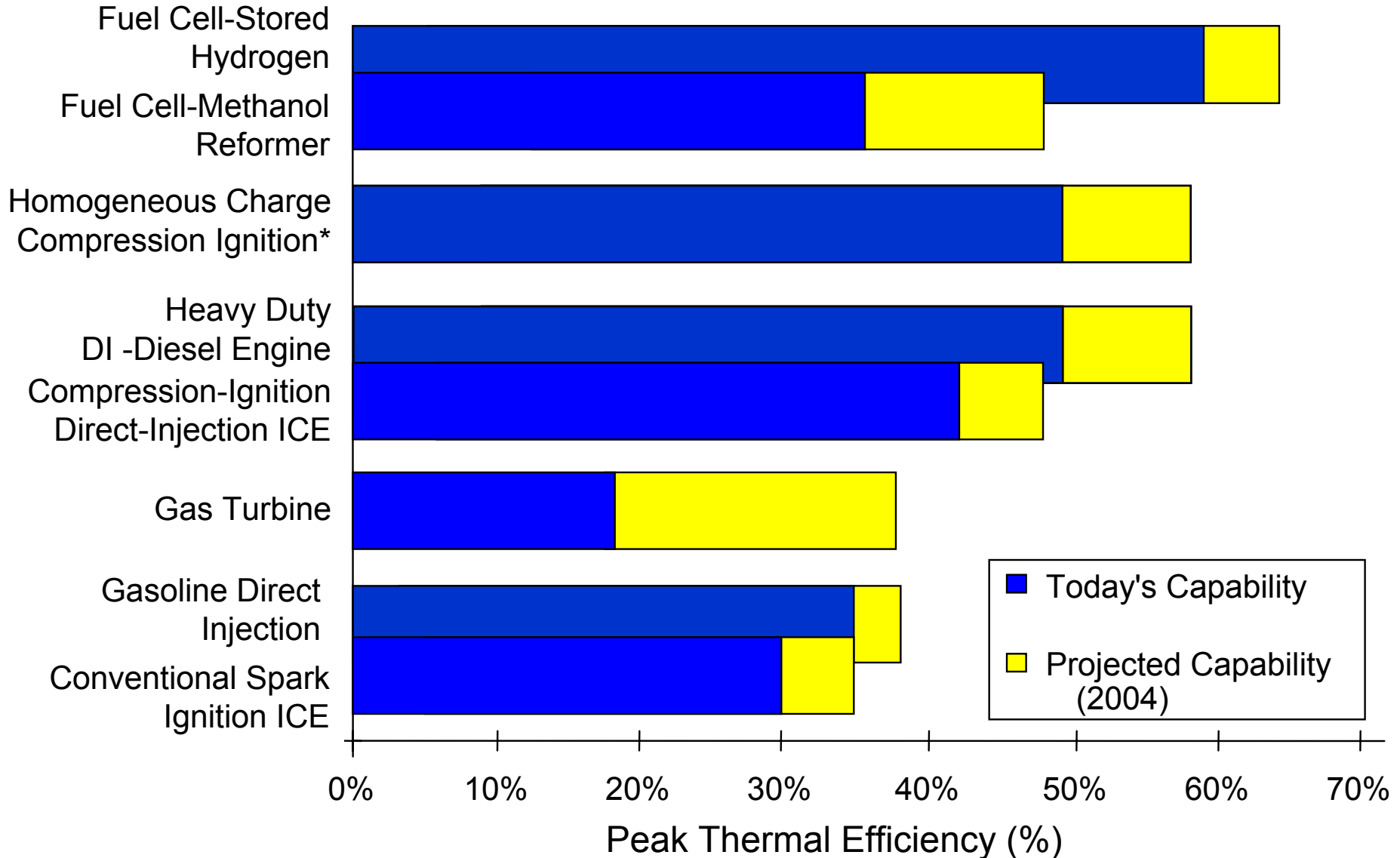
## Innovative Concepts

- CARAT
- GATE
- STICK

## Materials Technology

- Metals
- Composites
- Ceramics
- Propulsion Systems
- High Strength Weight Reduction

# Comparison of Energy Conversion Efficiencies



\* HCCI research focus: operate well across the load-speed map and extend the operating range to higher loads



# Budget Trends

Subprogram	FY 2002 Approp.	FY 2003 Request	FY 2003 House	FY 2003 Senate	FY 2003 Planning
Fuels Utilization R&D	25,908	18,483	22,183	25,173	22,183
Materials Technologies	40,293	29,800	38,900	38,800	36,300
Technology Deployment	3,600	6,000	4,600	6,000	4,600
Vehicle Technologies R&D - FCVT	113,197	99,280	127,780	111,280	111,280
Energy Efficiency Science initiative	4,000	0	4,000	0	0
<b>Total</b>	<b>186,998</b>	<b>153,563</b>	<b>197,463</b>	<b>181,253</b>	<b>174,363</b>

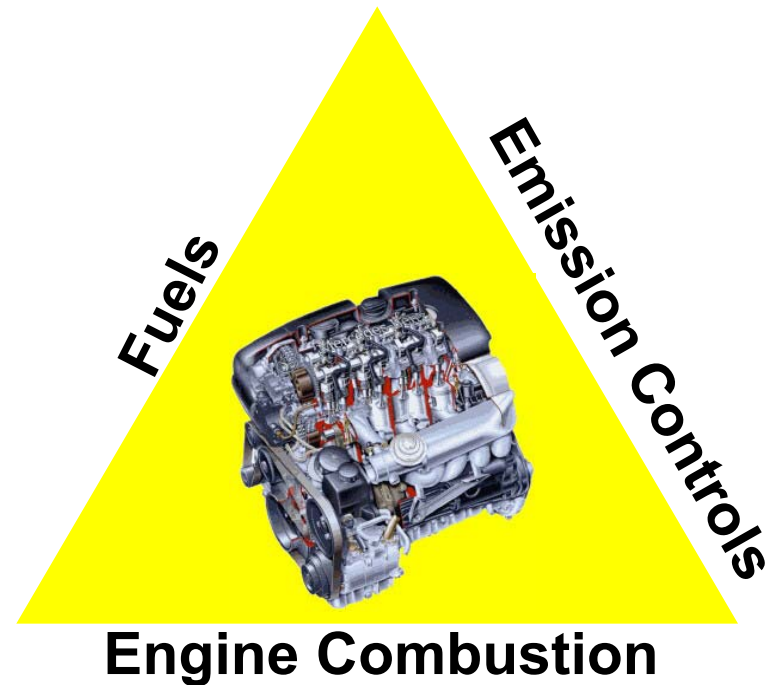
Notes: Thousands of dollars; The lower of the House or Senate Mark is used for planning





# Emissions from Diesel Engines have Improved

- **Integrated systems approach**
- **Progress made in all 3 areas**
- **Partnerships with leading industry suppliers, truck/auto manufacturing, energy companies, and national labs**
- **Cross-cutting applications**



**Auto** ↔ **Light Truck** ↔ **Heavy Truck**



# Future Liquid Fuels Strategy for Heavy Vehicles (Reducing Petroleum Dependence)

High-efficiency clean Diesel-cycle engines utilizing compression ignitable clean fuels/blends derived from diverse feedstocks

*Multiple Alternative Feedstocks*

*Clean Diesel Fuels/Blends*

*Advanced High-Efficiency Clean Diesel Engine Technologies*

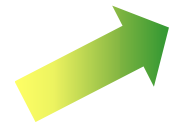
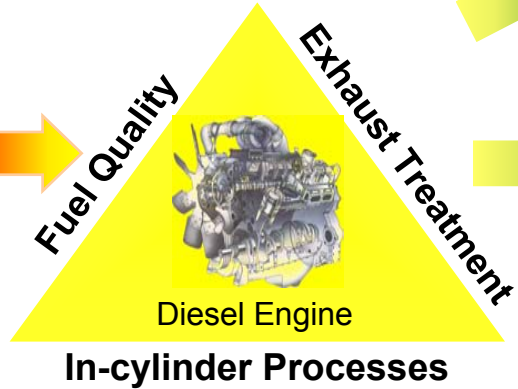
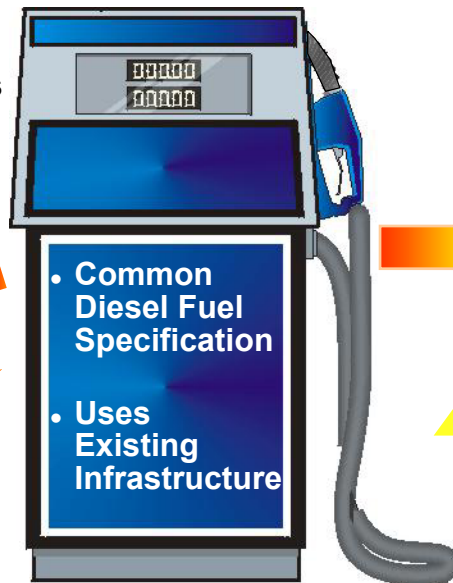
*Efficient Low Emission Heavy Vehicles*

- Coal
  - Biomass
  - Natural Gas
- 
- Petroleum

Synthesis gas route to:

Liquid Fuels

Conventional petroleum refining



Heavy Truck



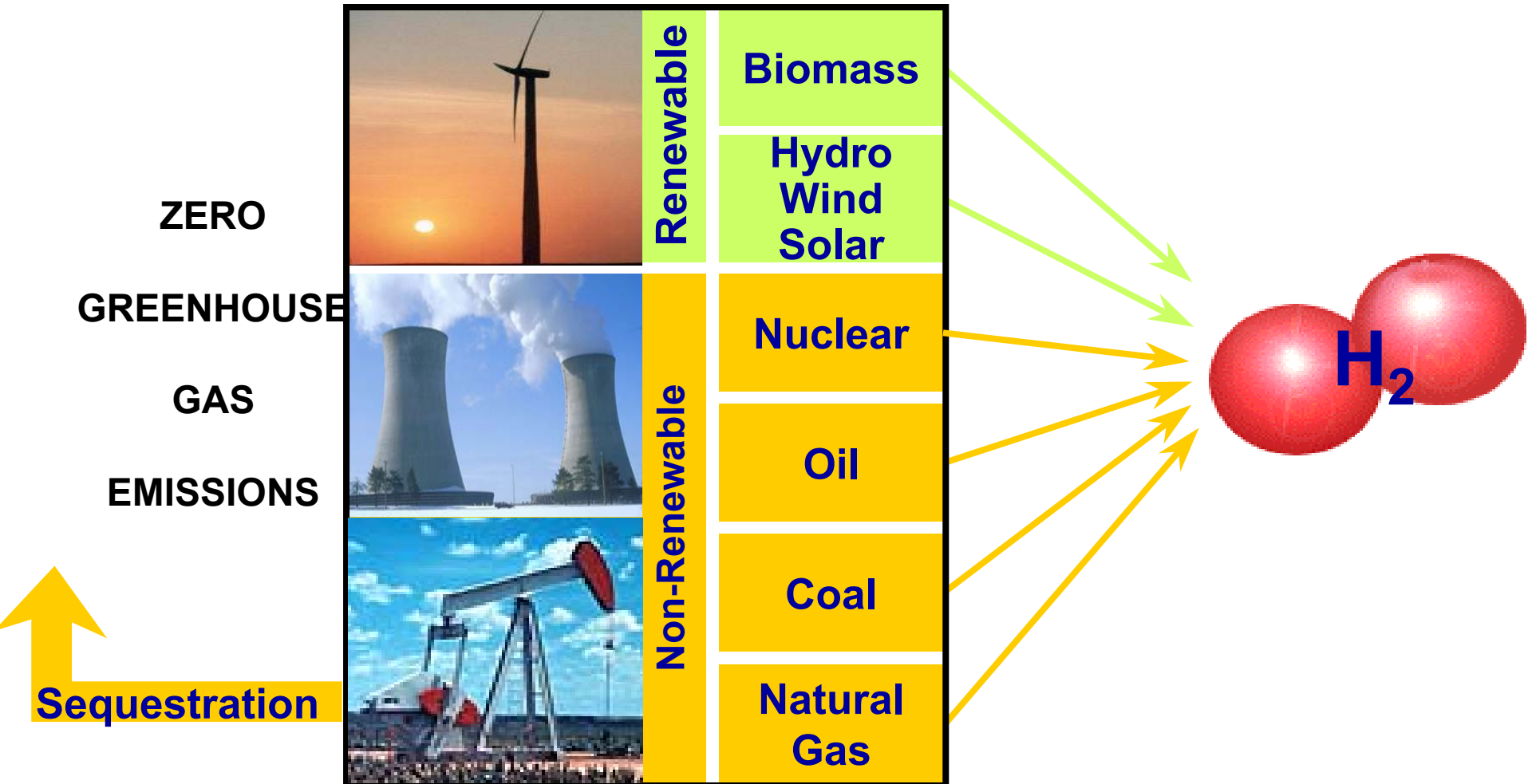
Construction/  
Farming Vehicles



Locomotive

# A Hydrogen Vision From FreedomCAR

- Freedom from petroleum dependence and pollutant emissions.
- Freedom to obtain fuel affordably and conveniently
- Freedom for Americans to drive where they want and when they want.





# Government/Industry Interactions

- **FreedomCAR:** Aggressive pursuit of five of the nine 2010 technological goals in advanced combustion and emission control, electric propulsion system, energy storage, ICE operating on hydrogen (shared with HFCIT), and materials technologies.
- **21<sup>st</sup> Century Truck Partnership:** Aggressive pursuit of dramatically improved fuel economy (100% improvement) with near-zero emissions through advancements in engine and aftertreatment, fuels, hybrid propulsion, materials and safety technologies, and reduction of parasitic energy losses.
- **Technology Introduction:** Build consumer confidence in advanced technologies and encourage private sector investment in infrastructure, support the annual acquisition of 12,000 AFVs and increased alternative fuel usage.