



PARTNERSHIP FOR A NEW GENERATION OF VEHICLES

Mobile Sources Technical Review Subcommittee

**April 18, 2001
Arlington, Virginia**

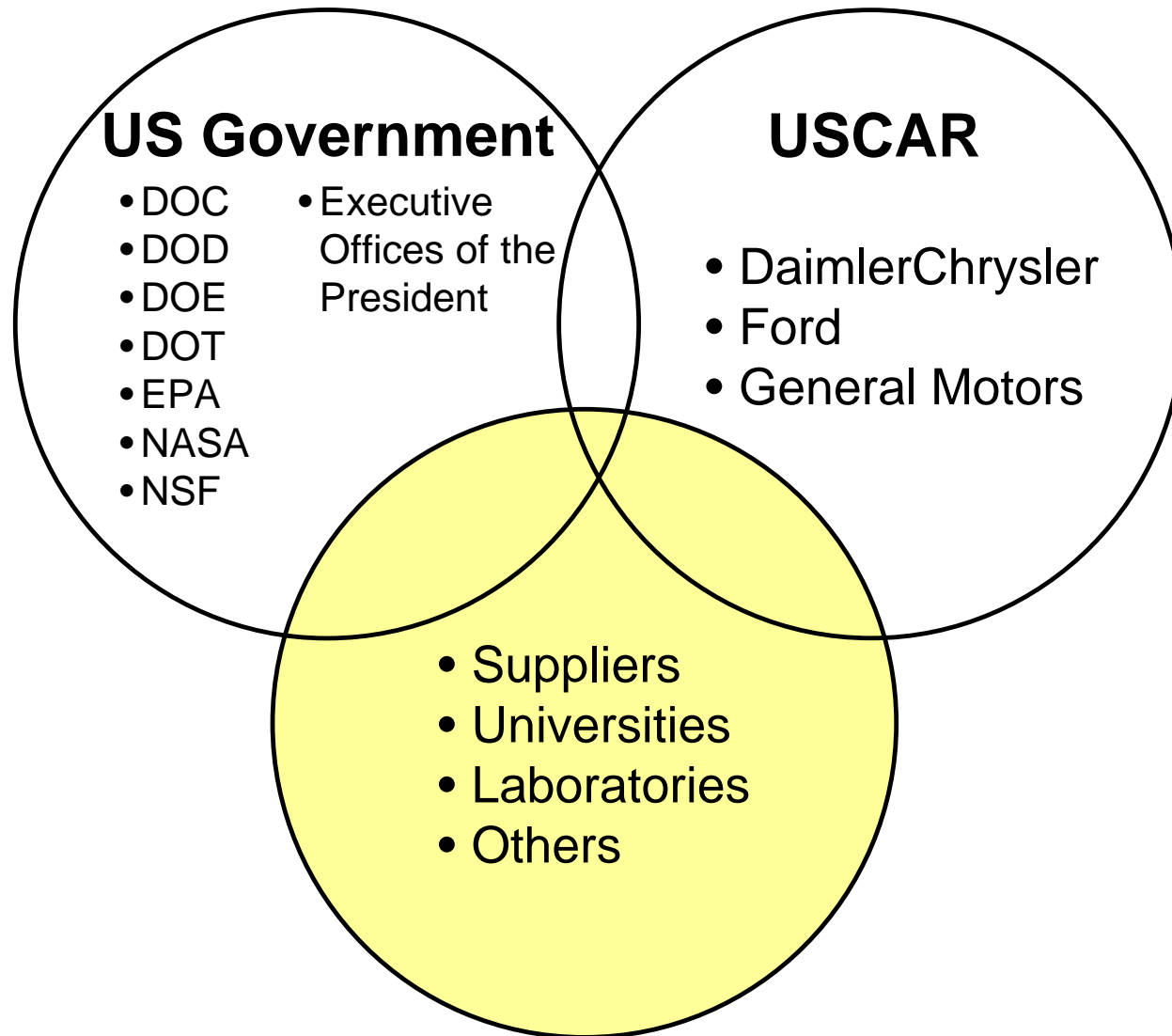
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Department of Commerce**



Presentation Overview

- ❑ **Brief background of PNGV**
- ❑ **The technical portfolio & challenges**
- ❑ **Progress to date**
- ❑ **Conclusions**

PNGV Participants



PNGV Goals



- ❑ **Goal 1:** Significantly improve national competitiveness in manufacturing
- ❑ **Goal 2:** Implement commercially viable innovations from ongoing research on conventional vehicles
- ❑ **Goal 3:** Develop a revolutionary new class of efficient, environmentally friendly vehicles that will meet the consumer's needs for safety, quality, performance, utility, and affordability

Research and Invention on Schedule

1995

2000

2004

Technology Areas:

- Advanced design simulations
- Advanced high power batteries and high energy batteries
- Alternate fuels, fuel storage
- Auxiliary power units, including DI and turbine
- Efficient air conditioning systems
- Electric propulsion components
- Engine efficiency technologies
- Flywheels
- Fuel cells
- Fuel reformers
- Low emissions technologies
- New materials and structures for mass reduction
- Ultracapacitors

Narrow
the
Technology
Focus

1997: Technology Selection

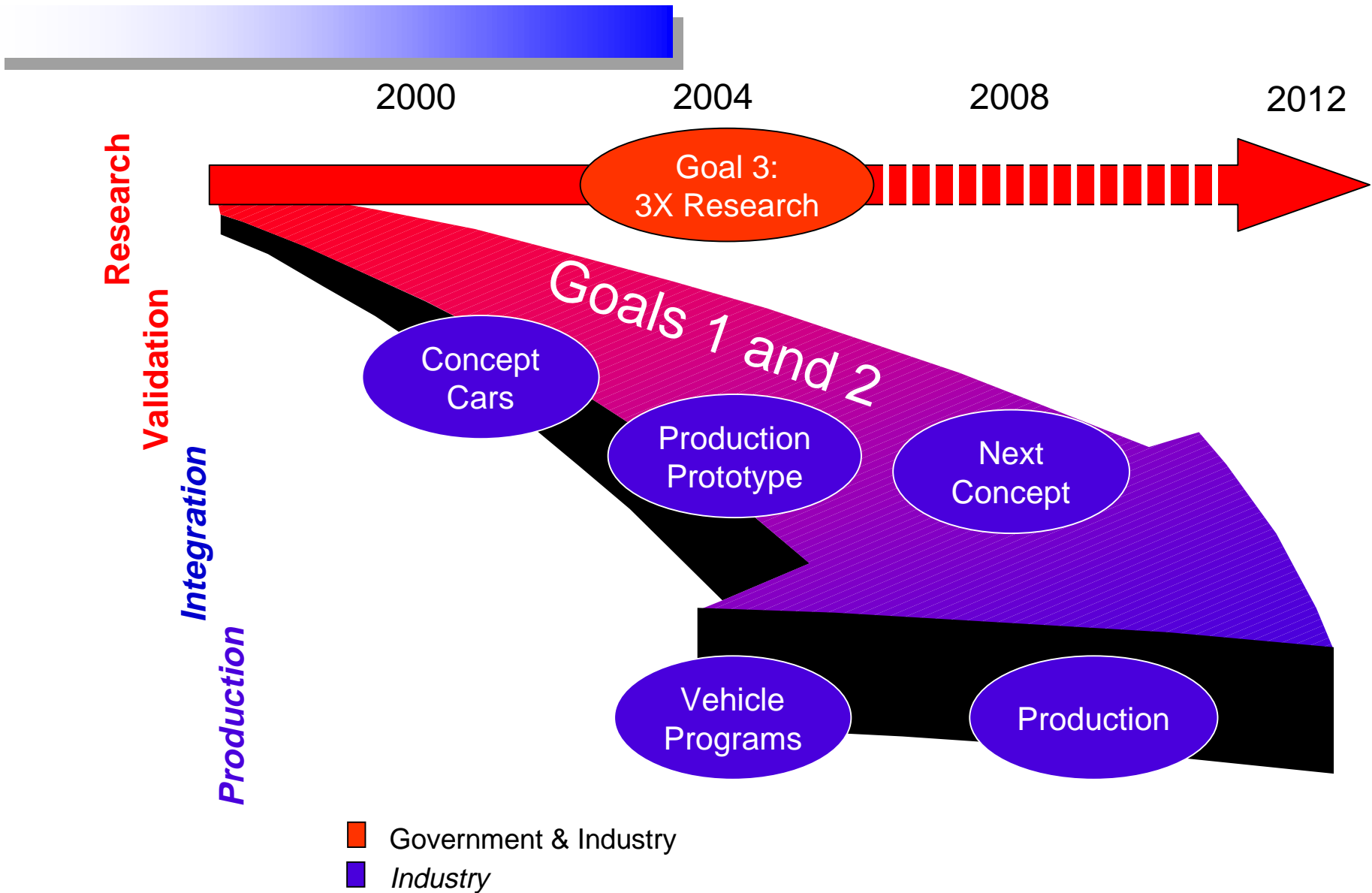
Focus & Accelerate
(Address the Issues)

Concept
Vehicles

Production
Prototypes

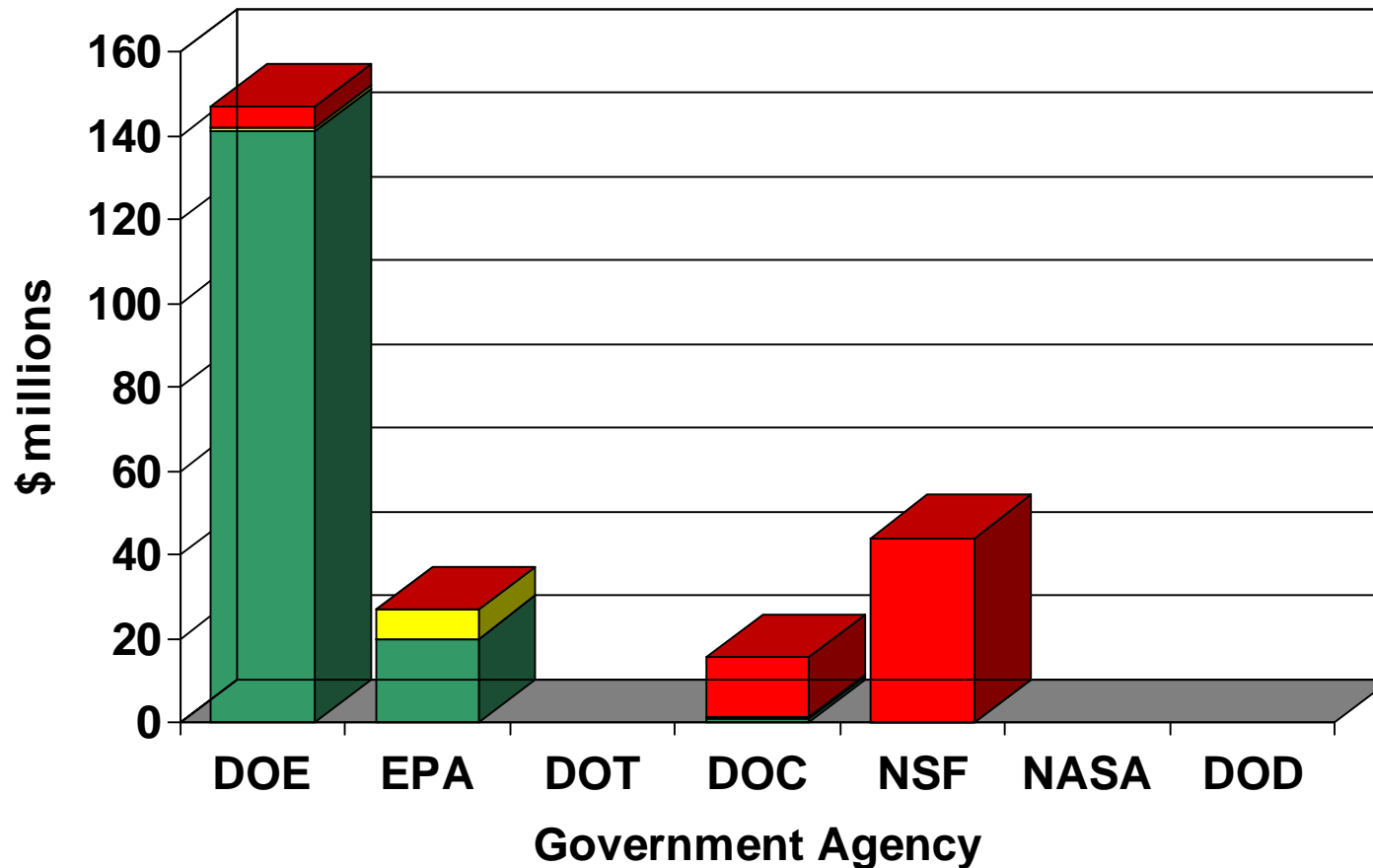


Technology Process



Total FY 2001 PNGV Government Budget Authority

- Work is **directly** relevant to PNGV and **is coordinated** with PNGV technical teams
- Work is **directly** relevant to PNGV but **is not coordinated** with PNGV technical teams
- Work is **indirectly** related to PNGV or **is supporting** long-term research



2000 PNGV Concept Vehicles

Ford Prodigy



- Lightweight materials reduce vehicle body structure weight 50%*
- Integrated starter/alternator*
- 33% reduction in aerodynamic drag
- Advanced diesel engine with 35% efficiency improvement projected to exceed 70 mpg (gasoline equivalent)*
- High-power battery *

GM Precept



- Vehicle body weight reduced 45% *
- World's most energy efficient vehicle lighting system
- Lowest drag coefficient ever recorded for a 5-p sedan
- Dual-axle parallel hybrid achieves 79.6 mpg (gasoline equivalent)

DaimlerChrysler ESX3

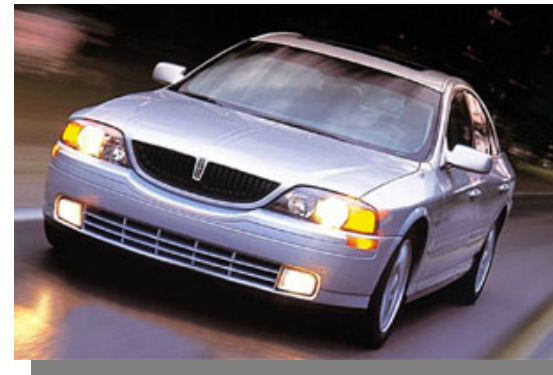


- Body system weighs 46% less*
- Efficient diesel engine, motor, and battery projected at 72 mpg (gasoline equivalent)*
- Cost penalty halved to \$7500

*Government supported technologies

Notable PNGV Technology Migration

- ❑ Hybrid-electric drives scheduled for the Dodge Durango in 2003, the Ford Escape in 2003, and the Chevrolet Silverado in 2004
- ❑ 412 pounds of lightweight aluminum in the 2000 Lincoln LS
- ❑ Aluminum used for door, deck, and hood panels for Cadillac, Oldsmobile, and Chevrolet vehicles
- ❑ 50-pounds lighter composite pickup truck box on the 2001 Chevrolet Silverado
- ❑ Production of a new, lighter, recyclable thermoplastic hardtop for the Jeep Wrangler in 2001



Technology Research Status



- ❑ **Hybrid Systems:** Parallel configuration offers best option to meet 80 mpg. Series configuration may be used with fuel cells. Cost, weight, and packaging remain as challenges.
- ❑ **CIDI Engines:** Mature technology with 44% efficiency, but NOx and particulate emissions remain as challenges.
- ❑ **Fuel Cells:** Lowest onboard emissions and potential for highest efficiency, but cost, systems integration, and fueling infrastructure are major challenges.
- ❑ **Energy Storage:** Considerable progress in developing high-power battery; focus now on cost and cycle life.
- ❑ **Power Electronics:** Progress on cost, power-to-weight ratios, and efficiencies continues
- ❑ **Light Materials:** Significant weight reductions achieved. Major issues are cost, manufacturability, joining, recycling, and repair.
- ❑ **Fuels:** Next generation of clean fuels is needed. Implications on infrastructure must be addressed. Evaluation continues on the effects of fuel composition and physical properties on engine performance and exhaust gas emission control efficiencies.

International Landscape of Advanced Vehicle Technologies

- ❑ PNGV has spurred the development of advanced automotive transportation worldwide.
- ❑ These advanced technologies are being developed with government support.
 - Both Honda and Toyota have received considerable Japanese tax credits and subsidies for the Prius and Insight
- ❑ Manufacturers pursuing different technologies and approaches – conventional engines with flexible fuel capability to advanced diesels and fuel cells.
- ❑ Over 30 concepts have been displayed worldwide.



Honda Insight

- ❑ 2-passenger
- ❑ Fuel economy: 64 mpg (combined) -- 1.8x improvement over the 1997 del Sol (manual)



Toyota Prius

- ❑ 4-passenger (Corolla sized)
- ❑ Fuel economy: 48 mpg (combined) – 1.3x improvement over the Corolla



Nissan Fuel Cell Effort

- ❑ Announced New Fuel Cell Effort
- ❑ \$720 million USD (1/17/01 date of exchange) over 5 years



**Subaru Concept
Elten Custom**



Toyota Concept HV-M4

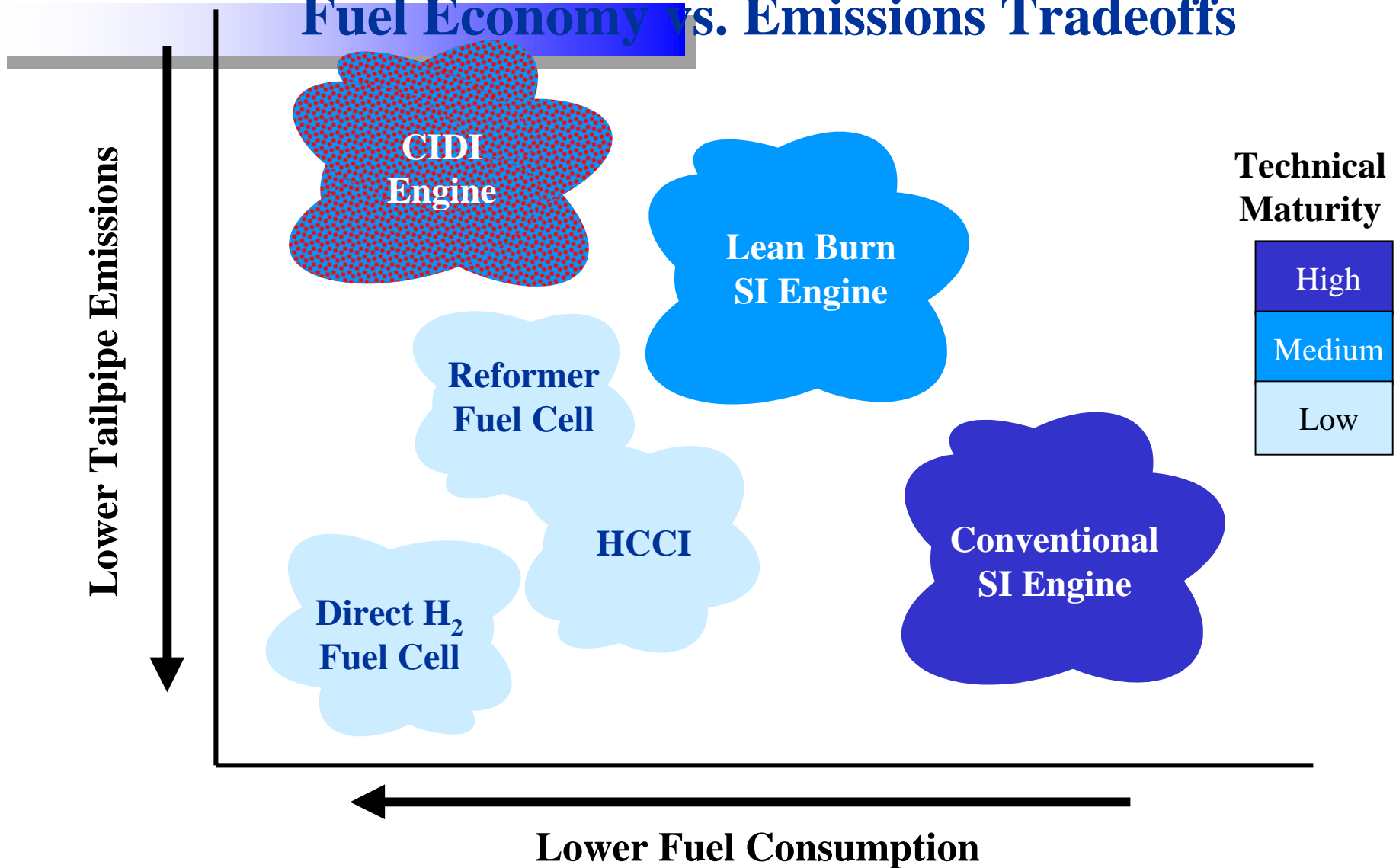
What's Coming?



- ❑ All three auto makers announced volume production of highly fuel-efficient hybrid vehicles within four years
- ❑ By 2004, three advanced technology production prototype vehicles that offer dramatically improved fuel economy will be delivered
- ❑ While most PNGV technologies can be applied to the light truck / SUV market segment, research is being expanded to include technologies unique to SUVs.

PNGV Propulsion Technologies

Fuel Economy vs. Emissions Tradeoffs



In Conclusion

The research has demonstrated the potential for significant improvements

Technical challenges to improve fuel economy are formidable and will take time

A balanced approach is needed in both technical and policy arenas

Public and private investment in advanced automotive R&D is essential

Cooperation between government and industry is accelerating progress and should continue