

NAMVECC 2003



Hybrid Vehicles

Will HEVs be the vehicle of the future?



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US Hybrid Announcements

- Honda Insight - 12/99
- Toyota Prius - 7/00 (12/97 Japan)
- Honda Civic Hybrid - 4/02
- Next Generation Prius - 10/03
- GM Parallel Pick-up - 04 MY
- Dodge Ram Contractor's Special - 04 MY
- Ford Escape Hybrid - 05 MY
- Lexus SUV HV - 05 MY (Highlander?)
- Saturn VUE HV - 05 MY
- GM 42V BAS - 06 MY
- Nissan Altima – 07 MY

Potential Hybrid Benefits

- Improved Fuel Economy
- Reduced Exhaust Emissions
- Improved Power Performance
- Combinations of the Above

What Does the Market Want?

A significant and growing percentage of customers indicate a willingness to buy an environmentally friendly vehicle

If, and only if, all other attributes are EQUAL

Prius History

Model Years	1998-2000 *	2001-2003	2004
City Label FE	43	52	60
Highway Label FE	41	45	51
Combined Label FE	42	48	55
0-60 Accel	14.5	12.5	10.5
Emissions	LEV	SULEV	AT-PZEV
Size Class	Subcompact	Compact	Midsized

*** Japan only**

Minor Model Change

Model Change

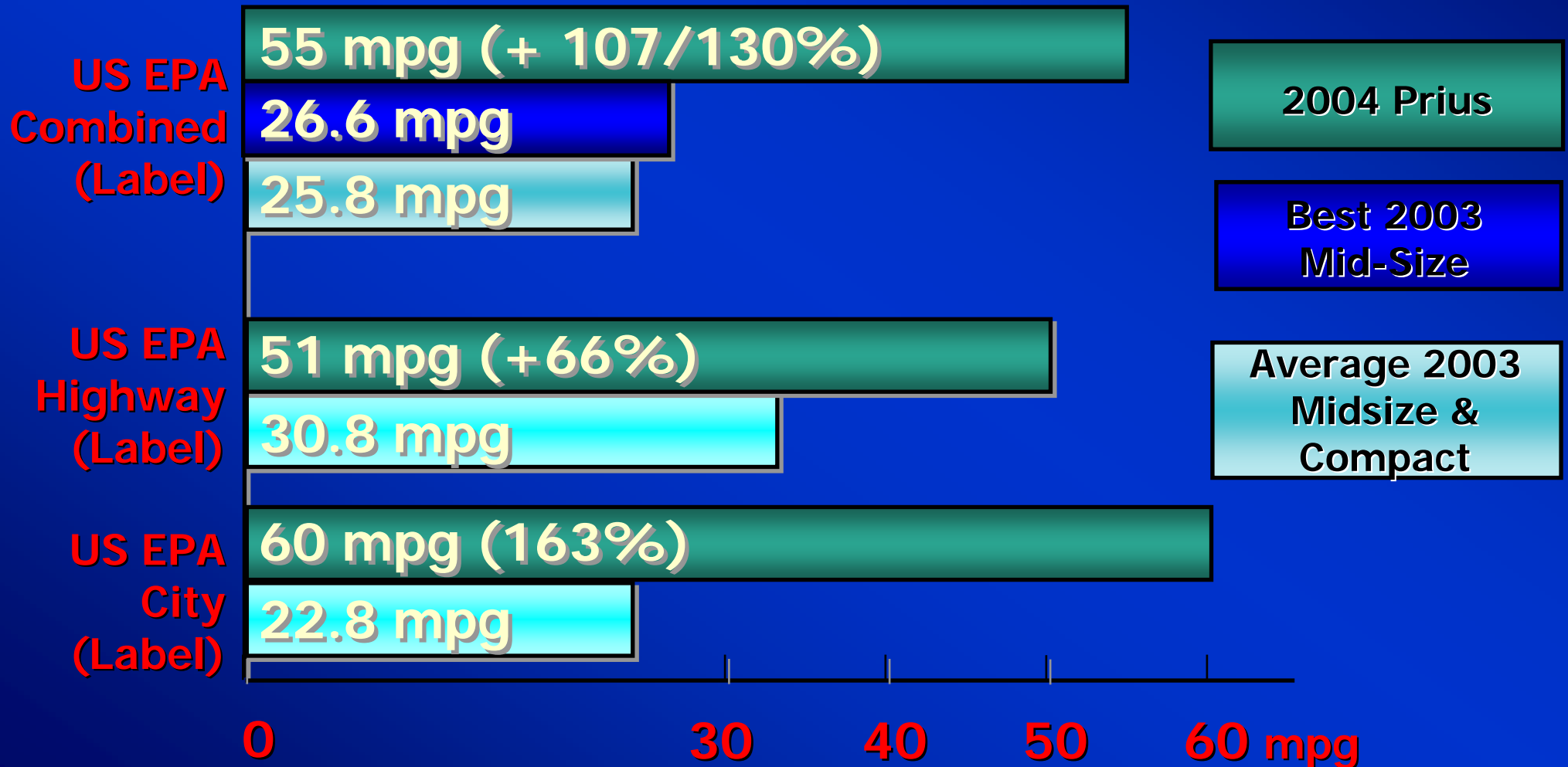
2004 PRIUS



2004 Prius Specifics

- Mid-size Liftback (112.3 ft³)
- \$19,995 MSRP base
- Increased standard equipment
- New options
- \$3,000 more than Corolla, but ~\$800 less than Camry
- 36,000 first year sales objective

Comparative Fuel Economy



Lexus RX Hybrid



RX Tease

- 3.3 liter V-6 Atkinson engine
- AWD
- At least 120 kW front motor
- At least 50 kW rear motor
- At least 200 kW peak power
- V-8 SUV performance
- Compact passenger car fuel economy

Toyota FCHV

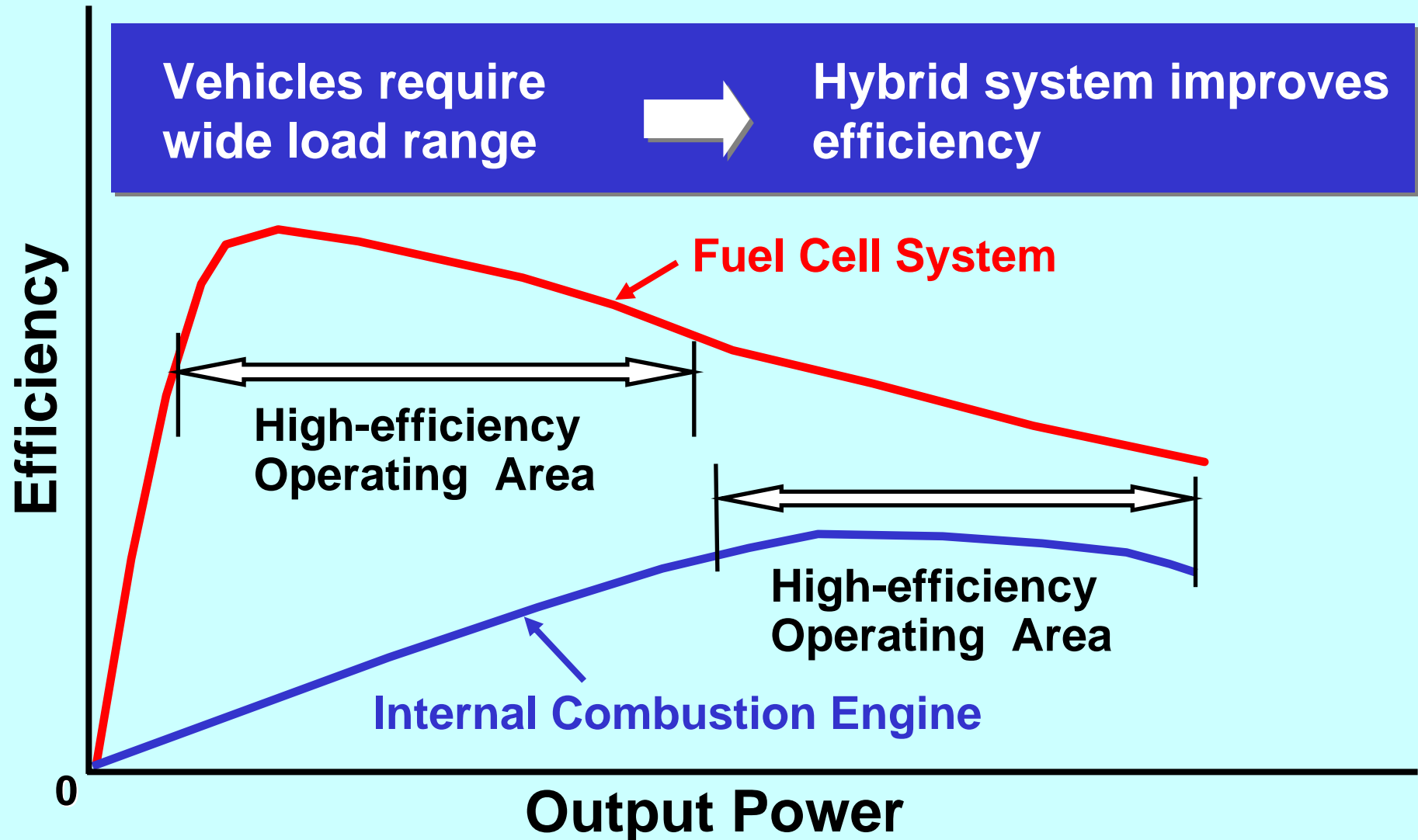


Why Hybridize a FC?

Vehicles require wide load range



Hybrid system improves efficiency



Toyota's Hybrid Technology

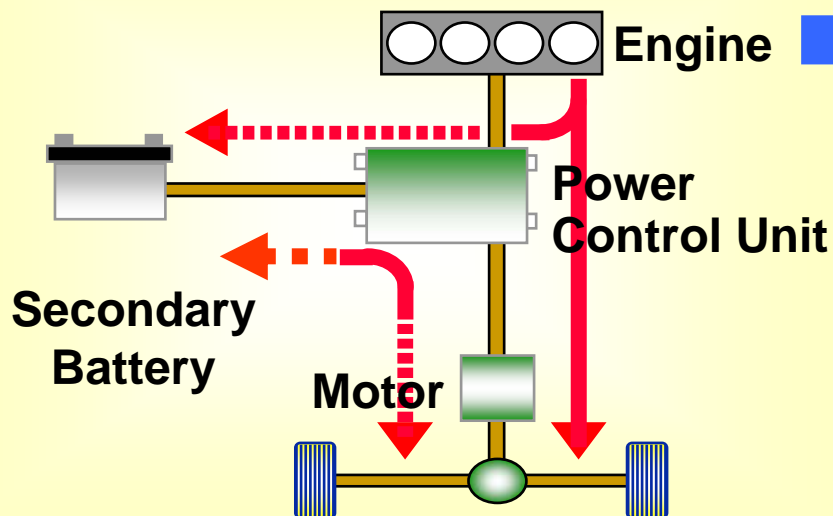
Prius



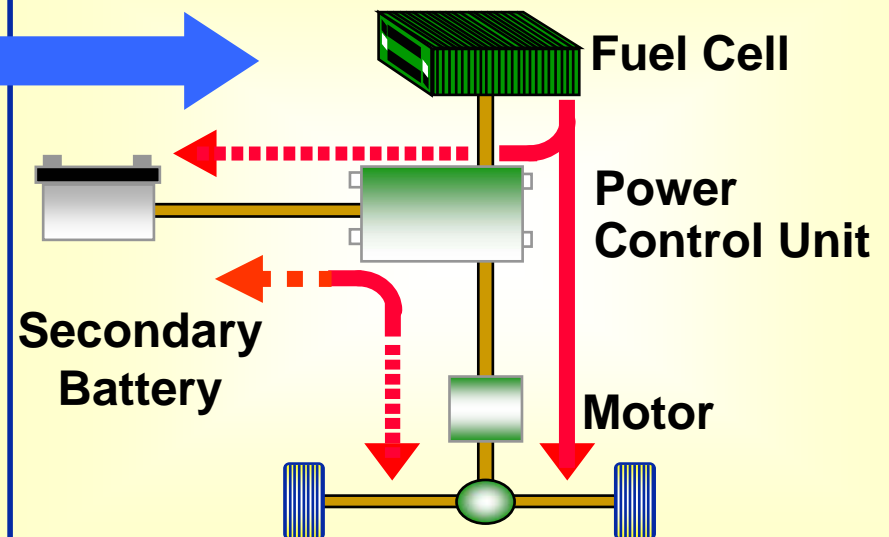
FCHV



ICE Hybrid Vehicle (Prius)



Toyota Fuel Cell Hybrid Vehicle



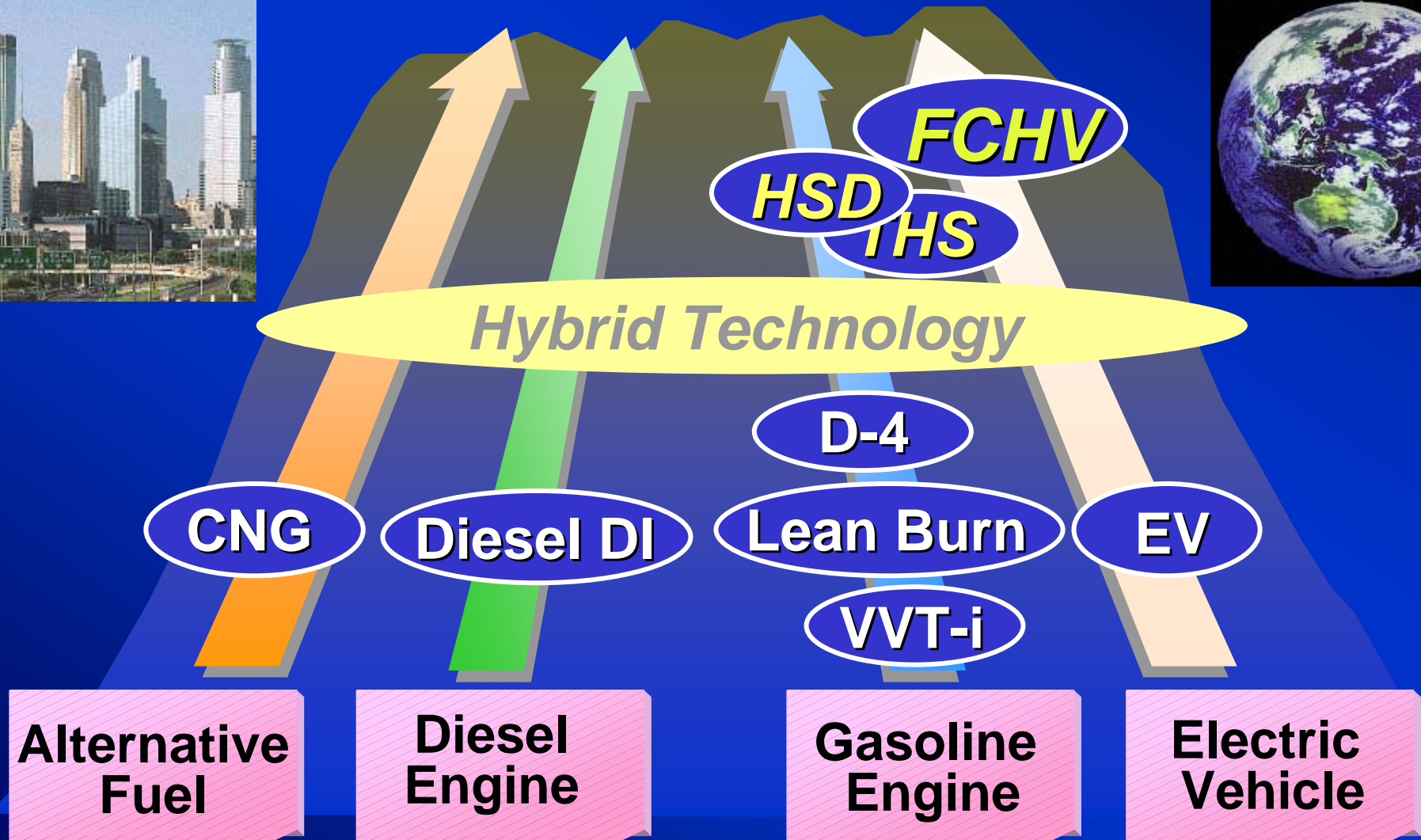
FCHV Features

- **4-door, 5-passenger SUV**
- **90 kW Toyota PEM stack**
- **80 kW permanent magnet motor**
- **Compressed H₂ at 5000 psi - ZEV**
- **NiMH hybrid battery**
- **0-60 mph in 12.8 seconds**
- **96 mph top speed**
- **64 miles per kg H₂ uncorrected efficiency**

Issues for Hybrids:

- **Target Selection**
 - Most US buyers value performance more than FE
- **Mitigation of Price Premium**
 - Learning will lower premium
 - Increased volume will lower premium
 - Unique attributes offset some premium, but
 - Incentives would increase volume in near-term
- **Market Confusion over Types and Benefits**
 - Not all hybrids created equal
 - But they may be marketed as if equal

The Ultimate ECO Car

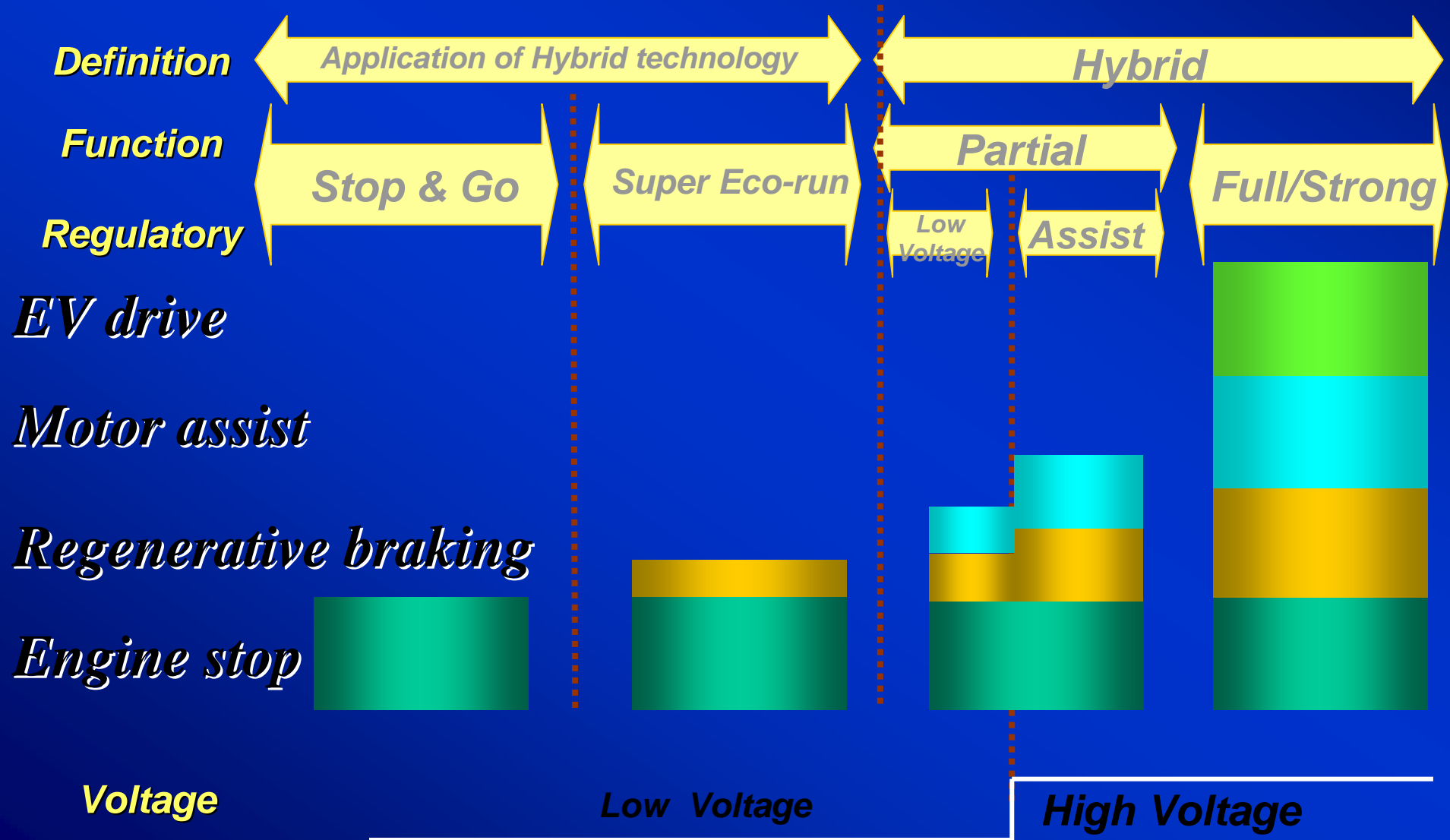


Will HEVs be the vehicle of the future?

HVs will gain a growing share of future sales

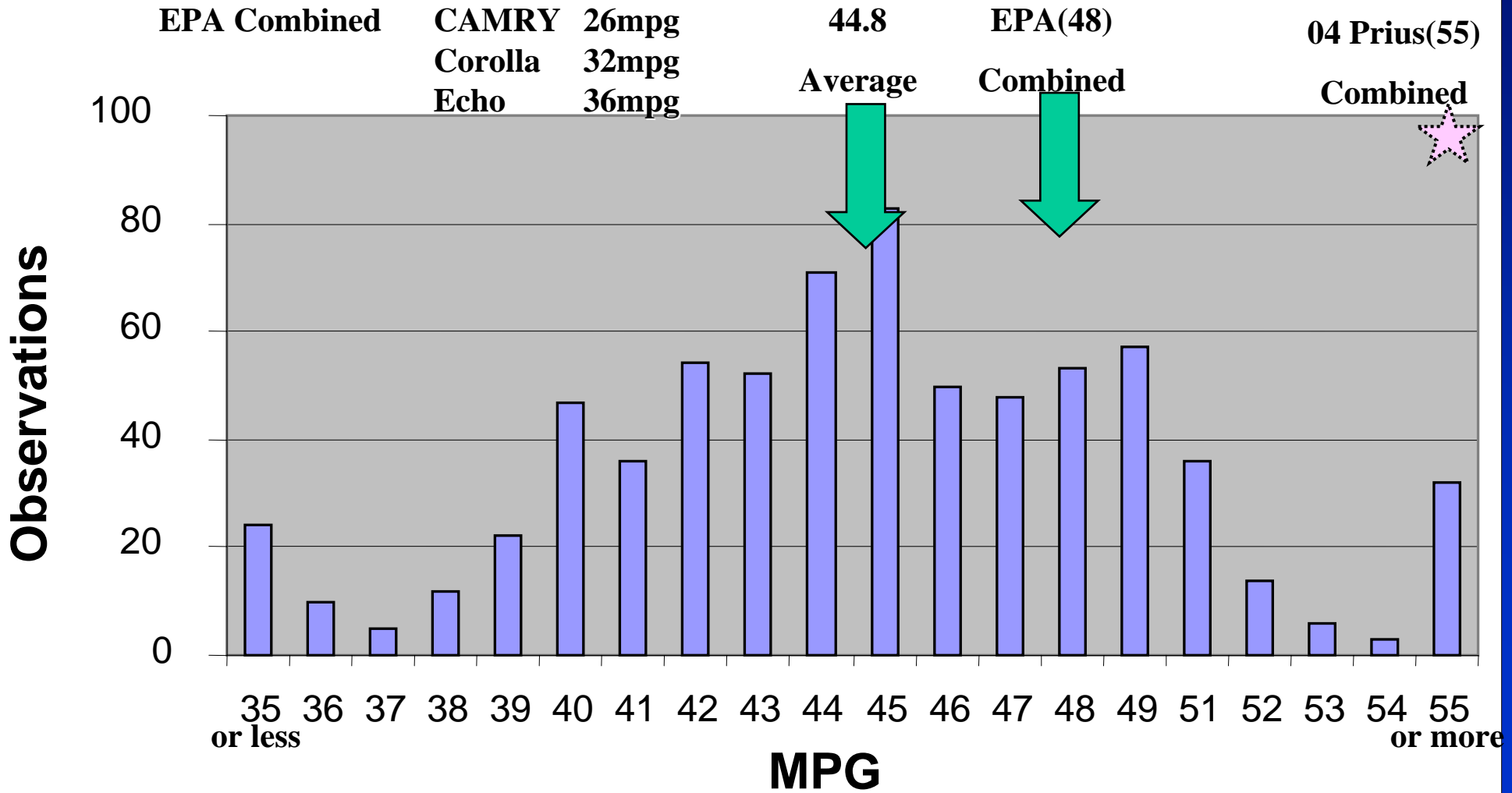
But, conventional ICE will dominate for many more years

HV Systems and Functions



“Real-World” Fuel Economy (01 Prius)

Customer Fuel Economy



Prius Comparisons

	MSRP	WB	Pass Vol	Luggage	Total Vol	Curb	Label FE
2004 Corolla	\$17,100	102.4	90.3	13.6	103.9	2590	29/38
2003 Prius	\$20,480	100.4	89	12	101	2765	52/45
2004 Prius	\$20,480	106.3	96.2	16.1	112.3	2890	60/51
2003 Camry	\$21,387	107.1	101.7	16.7	118.4	3296	20/28

Fuel Cell Vehicle Challenges

Stack - Cost, Efficiency, Durability, Power, Size

H2 Storage - Capacity, Weight, Volume, Cost, Durability

BOP - Efficiency, Size, Cost, Integration, Durability, Low temperature operation

Infrastructure - Who, How, Where, How many, When, Cost of infrastructure, Cost of product

Codes and Standards - Building codes, Fueling connector standards, Test standards (vehicle and components)

