

# Toyota ZEV Technologies Update

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# Toyota Fuel Cell Position

- Offers higher vehicle efficiency than any combustion powertrain
  - Hybridization further improves efficiency
- No emissions at the vehicle level
  - Criteria pollutants
  - GHGs
- Long-term hydrogen can be made from a variety of sources



# Toyota Fuel Cell Status

- 21 Fuel Cell Demonstration Vehicles in CA
  - ~60 global
- Three generations of technology
- Significant improvement in cold operation, range and durability
- Lots more development required
- Development requires only 30 vehicles per generation globally, more is a waste of manpower and money for no gain in learning



# Fuel Cell Challenges

- Range, even at 70 MPa, is too short
- Durability needs further improvement
- Cost is still far too high
- We need an energy storage breakthrough
- A renewable / carbon neutral source of hydrogen is needed
- Society must be prepared for the change
- Overall economics must work (Vehicle and Fuel)



# Toyota EV Position

- Vehicle attributes limit market to niche only
  - Utility
  - Cost
  - Range
  - Re-fueling time
  - Dedicated infrastructure
- No large format batteries in production
- Huge increase in Nickel commodity cost



# RAV4 EV Overall Experience

- Offered from MY 1998 through MY 2003
  - Last vehicle placed 9 / 26 / 03
- Over 1,200 placed in California
  - (including MOA)
- Over 800 currently in-service
- 36% / 64% - Retail / Fleet
- Global production ended in 2003 due to lack of viable market demand



# e-Com Experience

- City electric vehicle
- 19 units introduced in California
- 9 units used in ZEVNet Transportation Program with UC-Irvine
- Global production discontinued for lack of viable market demand



# **RAV4 EV Retail Experience**



# Retail Program Elements

- Offered proven RAV4 SUV platform
- Used successful Prius Internet/distribution system
- Established widespread network of 25 committed dealerships in all major markets
- Streamlined charger installation process
- Built high awareness with targeted multi-media marketing campaign
- Created attractive pricing and warranty package



# Retail RAV4 EV Features

- Two colors
  - silver & white
- Anti-lock brakes
- Dual front air bags
- Deluxe AM/FM radio with CD Player
- Split fold-down rear seats
- Alloy wheels
- Preheat / precool air conditioning w / timer
- Power mirrors, windows, and door locks
- Charger included



# Internet Information

- Website used as central source of information about RAV4 EV

Model features

Technology

Benefits of EVs

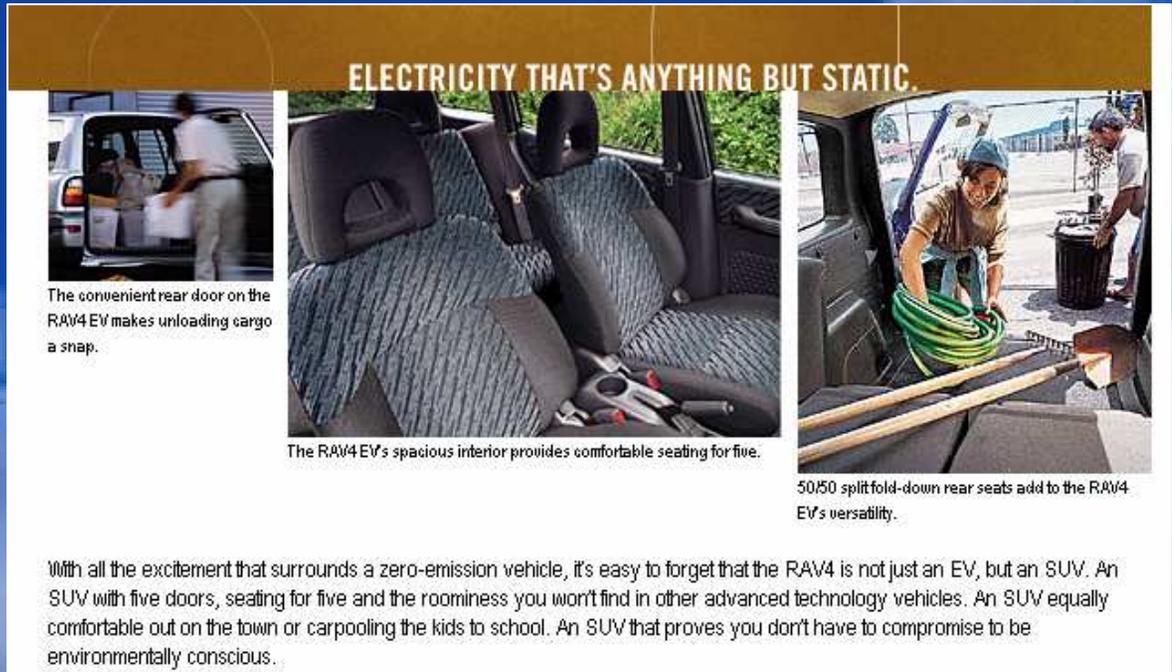
Availability/Dealers

FAQs

Order process

Public charger locations

**ELECTRICITY THAT'S ANYTHING BUT STATIC.**



The convenient rear door on the RAV4 EV makes unloading cargo a snap.

The RAV4 EV's spacious interior provides comfortable seating for five.

50/50 split fold-down rear seats add to the RAV4 EV's versatility.

With all the excitement that surrounds a zero-emission vehicle, it's easy to forget that the RAV4 is not just an EV, but an SUV. An SUV with five doors, seating for five and the roominess you won't find in other advanced technology vehicles. An SUV equally comfortable out on the town or carpooling the kids to school. An SUV that proves you don't have to compromise to be environmentally conscious.

- Allows customer to self-select



# Distribution Network

- Statewide market coverage
- 25 Dealers
  - Bay Area: 12
  - Los Angeles: 8
  - Sacramento: 2
  - San Diego: 2
  - San Joaquin: 1
- Significant investment
  - Sales and service training
  - Special tools



# Marketing and Advertising Overview

- Brochures
- Auto Shows
- Print Media
- Radio
- Television
  - Show Sponsorship
  - Spot Cable Ads
- Outdoor Media
- Interactive Media
- California & National Events
- Newsletter
- Stakeholder Relationships





# Auto Shows



Location	Date	Est. Attend.
Sacramento	Nov 2001	105,000
San Francisco	Nov 2001	286,000
Los Angeles	Jan 2002	1,200,000
San Jose	Jan 2002	208,000
Ontario	Feb 2002	178,000
San Diego	Feb 2002	687,000
<b>TOTAL:</b>		<b>2,664,000</b>



# Print Media

- Magazines
  - California Edition
  - 11 Targeted Pubs
  - March - September
- Newspaper
  - 4 Full Page Ads
  - LA Times, SF Chronicle, Sacramento Bee, San Diego Tribune, Santa Barbara News
  - March - May



# Radio and Television

## Radio

- :10 Metro Traffic Sponsorships
- Four 4-week flights in major metro areas



## California Golden Parks

- Product placement in California's Golden Park episodes
- Logo appearance in select shows
- Bookends (20-sec) lead in and out of each episode
- Show aired on PBS in California through end of July



Huell  
Howser



# Spot Cable

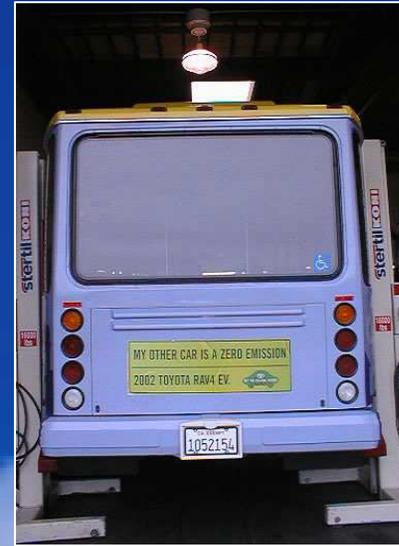
“360” TV Ad

:30 spot aired on  
selected cable



# Outdoor Media

- Out-of-Home
  - High Profile Locations
  - Billboards
  - Bus Shelters
  - Bus Tails
  - 17' Vertical Kiosks



# Interactive Media

Ad banners click through to RAV4 EV site



- Automotive: CarsDirect.com, Edmunds.com
- Endemic: EV World
- Environmental: Care2.com, Discovery.com
- News: LA Times.com, SF Gate, CBS MarketWatch
- Inv/Fin: E\*Trade
- Tech: Silicon Investor, Tech TV
- Merchandising: Fast Company, MIT Tech Review, Sierra Club



# Outreach to Advocates

Letters requesting support for RAV4 EV sent to ZEV Alliance members:

- Natural Resources Defense Council
- Coalition for Clean Air
- Union of Concerned Scientists
- Environmental Defense
- Sierra Club
- American Lung Association of California
- Planning and Conservation League



# Pricing

- Purchase price (inc. charger): \$42,000
  - less \$13,000 total incentives
- Lease price (inc. charger): \$1,000 down

Lease Period	RAV4 EV		Prius
	Before Lowenthal	After Lowenthal <sup>1</sup>	
36 months	\$579	\$329	\$329
48 months	\$516	\$329	NA
60 months	\$479	\$329	NA

<sup>1</sup> Excludes taxes



# Launch Media Cost

- **RAV4 EV Budget (CA)**
  - \$2.6M overall
  - \$9,615 per vehicle
- **Prius Budget (US)**
  - \$6.8M overall
  - \$567 per vehicle



# Advertising Impressions

## Feb-Sept 2002

Spot Cable TV	154,400,000
PBS California Gold	2,000,000
Magazine	99,700,000
Newspaper	10,200,000
Bulletin Boards	36,000,000
Other Outdoor	408,400,000
Interactive	44,600,000
Metro Traffic	16,500,000
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TOTAL RAV4 EV (CA Only)	771,800,000
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TOTAL PRIUS (US Total)	356,000,000

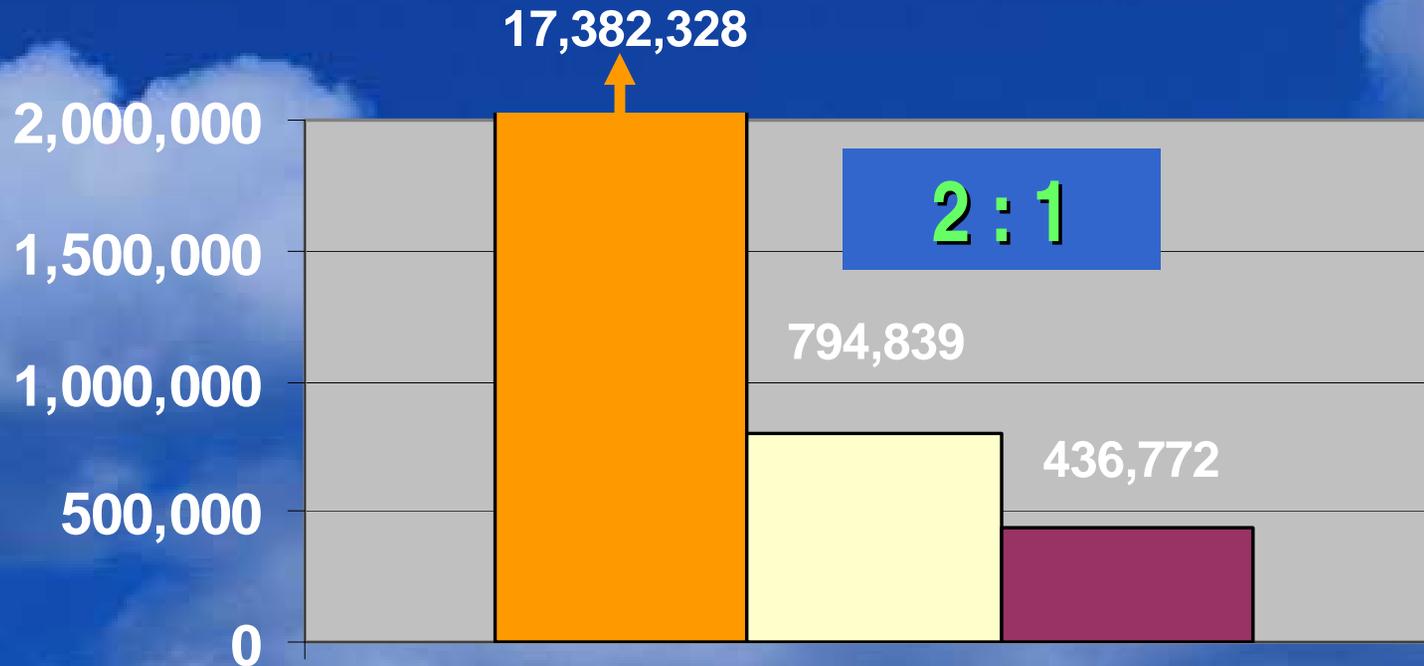
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# Web Site Activity

Feb-Jul 2002

RAV4EV.com received 82% more visits than Prius.com

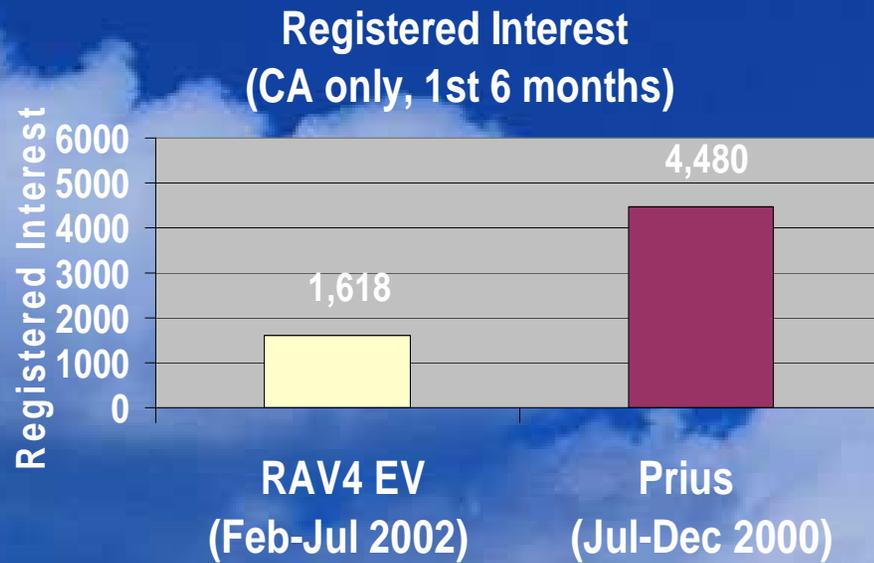


Feb-July 2002 Website Visits

■ Toyota.com ■ RAV4EV.com ■ Prius.com



# Consumer Interest Launch Comparison



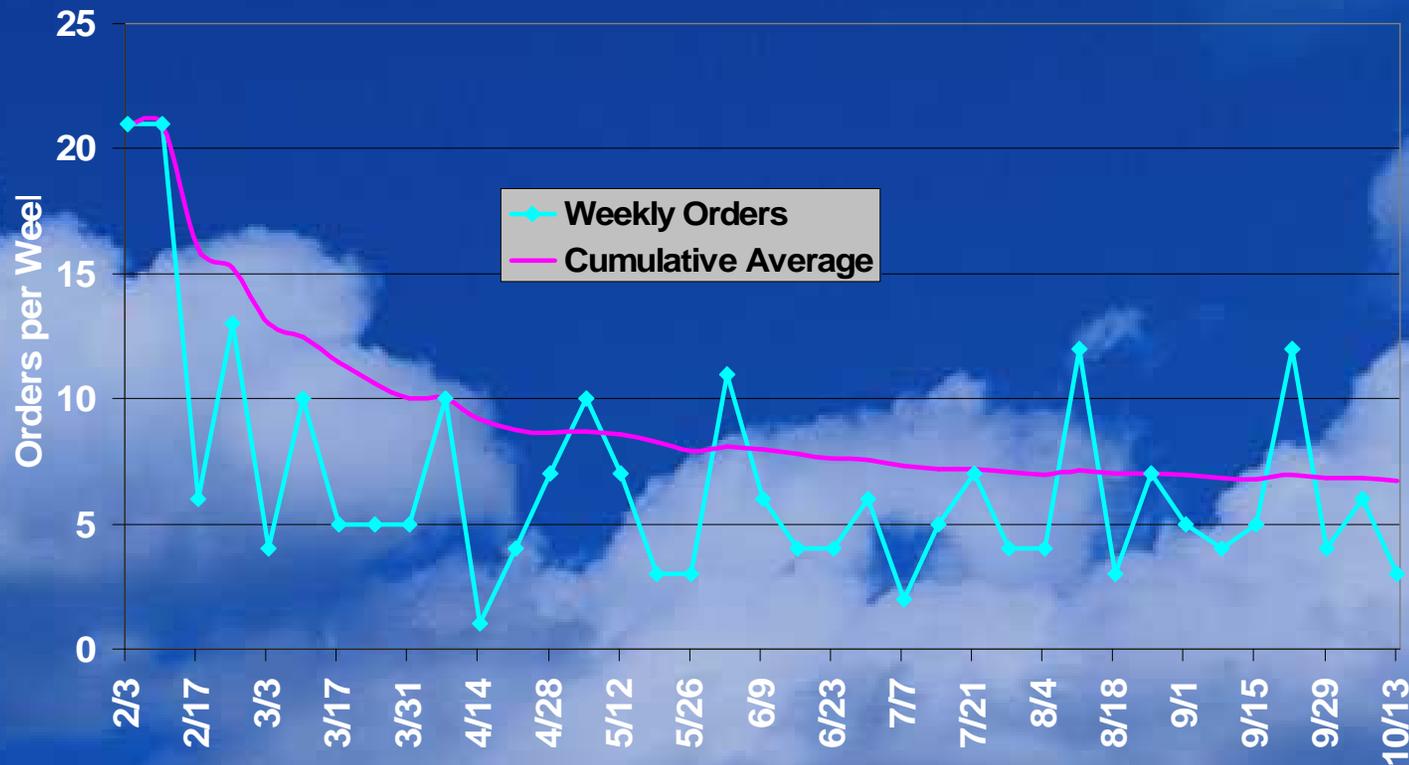
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# Order Pace Through Oct 13, 2002



- Average pace: 6.7/week (includes 1<sup>st</sup> 2 weeks)
  - Average pace: 5.8/week (excludes 1<sup>st</sup> 2 weeks)



# Customer Demographics

Category	RAV4 EV <sup>1</sup>	Prius <sup>2</sup>
<b>% Female</b>	<b>18%</b>	<b>53%</b>
<b>% Male</b>	<b>82%</b>	<b>47%</b>
<b>Median Age</b>	<b>46</b>	<b>52</b>
<b>Median Income</b>	<b>\$115,000</b>	<b>\$89,286</b>
<b>% Buyers</b> (vs lessors)	<b>22%</b>	<b>98%</b>
<b>% Lessors</b> (vs buyers)	<b>78%</b>	<b>2%</b>

<sup>1</sup> 83% are business owners, executives or professional or technical specialists  
47% have at least some post-graduate education

<sup>2</sup>Source: CDS Q1-Q2 2002



# Shopping Patterns

- RAV4 EV customers sought out an EV
- 19 of 87 replaced another EV in HH
  - 9 of 87 still have another EV in HH
- 40 of 87 did not consider another model
  - Of those that did consider another model, 85% would have acquired another alternative fuel or hybrid vehicle as a 2nd choice



# Retail RAV4 EV Summary

- Awareness was high, but sales were low – and not increasing over time
  - Media spend >15 times Prius per vehicle
- Pent-up demand was small
  - <50 units in first 2 weeks
- No competition during the program – best case
  - Annualized volume ~ 300 vehicles per year
- Extremely expensive investment for Toyota
  - Not profitable and no expected future profitability
- Prius AQ improvement is far greater at market volumes



# Toyota Hybrid Position

- **Hybrid is a core technology for the future**
  - Reduced criteria pollutants
  - Reduced fuel consumption and GHG emissions
  - Increased driving satisfaction
- **Hybridization increases efficiency of all prime movers including future fuel cell vehicles**
- **Hybrid marketing increases awareness and interest in clean (low emissions) vehicles**
- **Battery warranty requirements (not impacting emissions) are outside the purview of ARB**

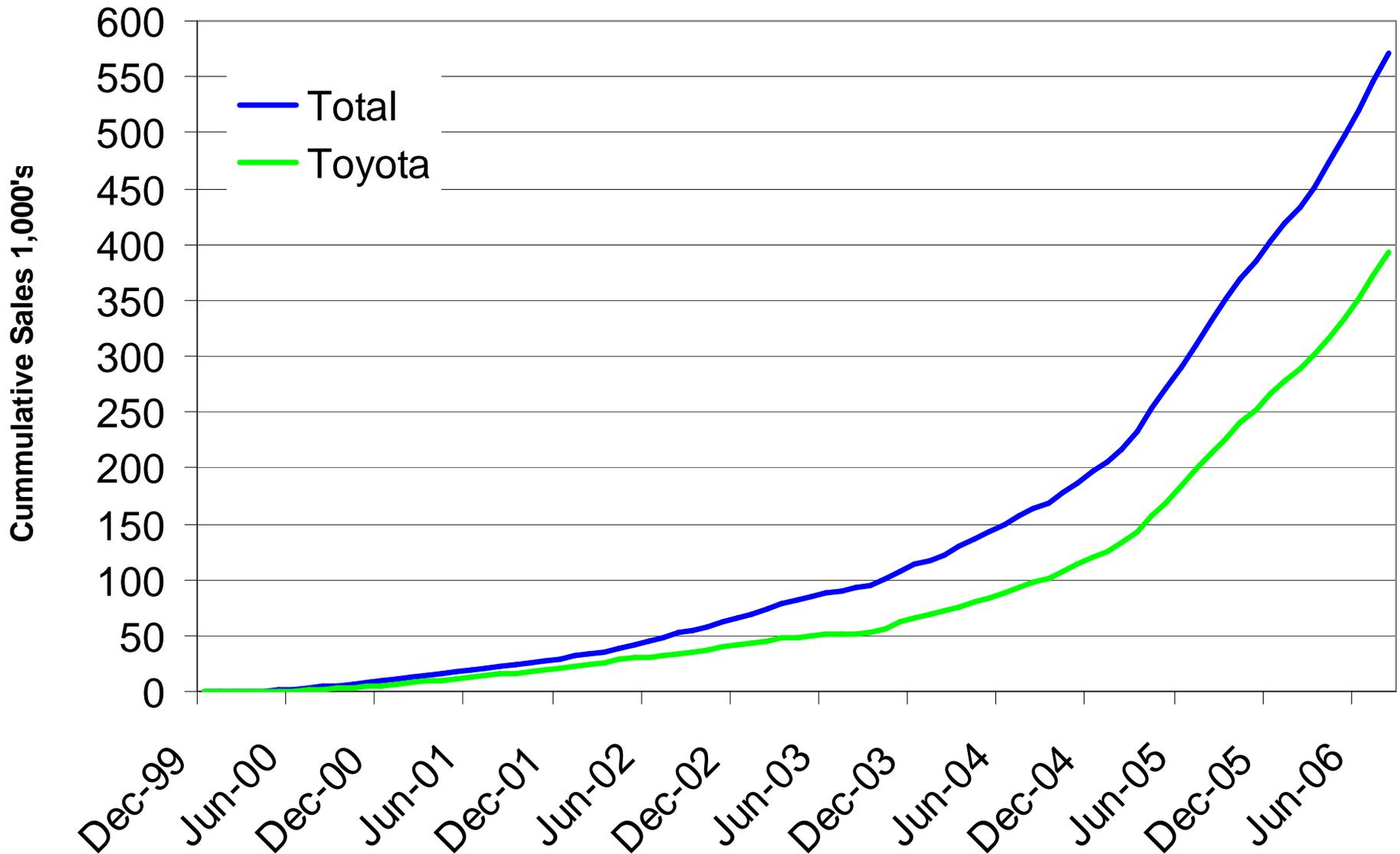


# Toyota US Market Hybrids

- 2001-2003 Prius
- 2004-200x Prius
- 2006 RX 400h
- 2006 Highlander Hybrid
- 2007 GS 450h
- 2007 Camry Hybrid
- 2008 Lexus LS 600h-L
- More to follow



# Cumulative US Hybrid Sales



# Hybrid Value Proposition

- Since the vehicle purchase process is more than an academic exercise in logic, we look at more than just years to recover cost or acceleration performance
- Manufacturers strive to find the combination of features (including hybrid attributes) that customers value and are willing to pay for
- It is likely that this combination will vary by model and certainly will vary by segment
- As new models are introduced this balance may change and it may evolve over time as market forces change



# Global Toyota Hybrid Goals

- ✓ 50% cost reduction by 2004 Model
- ✓ 300,000 hybrids total by 2005
- ✓ 300,000 per year rate by mid-decade
  
- 1,000,000 total in 2007
- Additional 50% cost reduction by early next decade
- 1,000,000 per year rate by early next decade



# Toyota Plug-in Hybrid Position

- As a long term vision, Plug-in HVs are an appealing technology in terms of energy diversity. Depending on grid mix and manufacturing efficiency they may offer reduced life cycle CO<sub>2</sub> and reduced fuel consumption at the same time \*

\* To reach this vision, however, it is necessary for us to have breakthroughs in battery technology, including capacity, durability and cost.

With today's latest technology, Plug-in HV is not commercially and technologically feasible.



# DOE Plug-in Workshop (May '06)

- The technical merit of plug-ins is reduced oil consumption and transportation energy diversity
- Batteries are the key issue
- Reduced fuel consumption trumps all electric range
  - AER must not be required as it drives design / cost
- V2G (Vehicle to Grid) is a future possibility, not today or near-term

**Toyota agrees with these conclusions**



# Plug-in Application

- **Much more battery on board**
  - Mass, volume & cost impacts
- **Energy storage system**
  - More like consumer electronics than today's hybrids
- **Wide daily swings of SOC**
  - Historically 100% to 20%
  - Much more stressful for the battery than today's HV
- **Durability becomes a real issue**
  - Plug-in battery life is not known, life of vehicle battery is very challenging
  - Major in-use cost impact if not life of vehicle

