



# **ZEV Mandates: Concerns & Potential Impacts**

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# CA ZEV Mandate - History

- **Adopted in 1990, a 6 sentence footnote to the LEV regulation**
- **Modified in 1996 to eliminate the 98-02 requirement, <1 full page**
- **Modified in 1998 as part of LEV2 with PZEVs, 6.5 pages as new reg**
- **Overhauled in 2001, currently 20 pages**

# CA ZEV Mandate - Rqmts

- **In 1990, 10% ZEV in 2003, with 2% from '98-'00 & 5% from '01-'02**
- **In 1996, 10% ZEV in 2003, no ramp-up & '98-'00 MOAs**
- **In 1998, 4% ZEV in 2003 + 6% PZEV & new credit structure**
- **In 2001, 2% ZEV + 2% ATPZEV + 6% PZEV in 2003 & ramp-up credit**

# CA Volume Implications

- **PC + LDT1 -  $\sim 1,000,000$ /yr**
- **LDT2 -  $\sim 700,000$ /yr**
- **LDT2 ramps into program '07-'12**
  - **ZEVs are 0.15-5 credits/vehicle**
  - **ATPZEVs are  $\sim 0.5$  credits/vehicle, so 2% requires about 4% actual vehicles**
  - **PZEVs are 0.2 credits/vehicle, so 6% requires 30% actual vehicles**

# **ZEV Review Process**

- **Manufacturers submit product plan**
- **ARB visits each manufacturer**
- **2 workshops**
- **BTAP and other contractor reports**
- **Staff report and public meeting**
- **Staff proposal and Board Hearing**
- **Staff modifications per Board**

# **Staff Report (8/00)**

- **Actually a reasonably accurate, but optimistic assessment**
- **Includes cost estimates and emissions benefits**
- **But, does not calculate cost benefit (\$1,800,000/ton)**
- **Suggests a market exists, but not without huge subsidies**

# Battery Panel Assessment

- **Again, a reasonably complete, but optimistic document**
- **Says Ni-MH is the only viable technology for the next 6 or more years**
- **Shows cost curves that never reach targets**
- **Should be read as dooming EV**

## **Board Direction (9/00)**

- **We have a vision, we want ZEVs**
- **Directed staff to draft a regulation preserving the ZEV program**
- **Meeting had a religious zeal much changed from historic ARB proceedings**



# **Staff Recommended Changes (12/00)**

- **Major reductions in required volumes, new credits games**
- **Accept Grid-HEV as a gold vehicle**
- **Allow a phase-in for PZEVs**
- **Boost EV % requirement in out-years**

## **Board Action (1/25/01)**

- **Redefine the ZEV volume baseline by adding trucks (SUV guilt)**
- **Move grid-HEV to Silver (bad gas)**
- **Double the number of ZEVs from staff recommendation by 2009**
- **Essentially requires a complete re-write of staff's proposed regulation**

# **Final ARB Action**

- **ARB issued three sets of changes to adopt the Board's direction**
- **Rational support of technical risk compromised to get more volume**
- **Final package to OAL 12/8/01**
- **OAL rejected 1/28/02 - procedural issues**
- **ARB repairing, due soon**

# Other ZEV Programs

- **Vermont is adopting the CA program starting in 2005**
- **New York and Massachusetts have adopted CA program in 2005, but will accept an ACP beginning in 2004**
- **New Jersey has introduced legislation**
- **Others may follow**

# **ZEV Vehicles - Gold**

- **Battery EV**
  - Highway capable
  - City capable
  - Neighbor vehicles
- **Hydrogen Fuel Cell Vehicles**

# Full Function EV



# **RAV4-EV - Features**

- **4-door, 5-passenger SUV**
- **NiMH batteries - ~29 kWh, 1000 pounds**
- **Regenerative braking**
- **High efficiency permanent magnet motor**
- **78 mph top speed**
- **80-100 miles real world range**
- **\$42,000 MSRP with charger**
- **Favorable lease terms for 36, 48 or 60 months**
- **5 year battery warranty**

# **RAV4-EV Placements**

- **716 in CA, 949 nationwide**
- **Mostly electric utilities and government fleets**
- **Some units at >60,000 miles**
- **Generally positive feedback from customers**
- **Retail availability in CA 02/02**
- **2002 available for sale or lease**



# **Other Full Function EVs**

- **Ford plans limited availability of Ranger EV**
- **No other announcements for 2002**

# City EVs



# **(Ford) Think City**

- **2-door, 2-passnger mini-car**
- **Lead-acid batteries - 72 V**
- **Regenerative braking**
- **DC motor**
- **62 mph top speed**
- **50 mile range**
- **US demonstrations with EU vehicles in 2001**
- **\$199/mo for 34 months during demo**
- **4th quarter 2002 production availability**



# Other City EVs

- **Toyota e-com**
  - 103 worldwide, 15 in CA
  - Demonstrations only
  - Many demos include ITS
  - Ni-MH battery
  - No production plan
- **Nissan Hypermini**
  - Demonstrations only
  - Many demos include ITS
  - Li-ion battery
  - No production plan



# NEVs (LSVs)





# (DCX) GEM NEV

- 2-passenger and 4-passenger
- Lead-acid batteries - 72V
- Regenerative braking
- 25 mph top speed
- ~7,000 total US sales
- \$6,995 - \$8,995

Two Passenger



Short Utility



Four Passenger

# **(Ford) Th!nk Neighbor**

- **2 and 4 passenger models**
- **Lead-acid batteries - 72V**
- **Regenerative braking**
- **25 mph top speed**
- **On sale 4th quarter 2001**
- **\$6,500 - \$8,000**



# Other NEVs

- **Dynasty**
- **Lido**
- **Bombardier**



# Hydrogen Fuel-Cell Vehicles



# H2 FCV - Features

- **PEM fuel cell - multiple manufacturers**
  - **Ballard**
  - **Toyota**
  - **Honda**
  - **IFC**
  - **GM**
- **H2 storage options**
  - **Hydrogen absorbing alloy fuel storage**
  - **Cryogenic storage**
  - **Compressed gas storage**

# H2 FCV - Challenges

- **FC Stack**
  - power, efficiency, size, cost, durability..
- **Hydrogen Storage**
  - capacity, weight, cost, durability..
- **FC System**
  - efficiency, size, cost, durability, low temps...
- **Hydrogen Infrastructure**
- **Regulation, Standardization**

# **ATPZEV Vehicles - Silver**

- **CNG**
- **Hybrids**
  - **Grid independent**
  - **Grid connected**
- **Reformer Fuel Cells**

# **ATPZEV Requirements**

- **SULEV tailpipe emissions (~90% below ULEV)**
- **Zero fuel evaporative emissions**
- **150,000 mile durability**
- **150,000 mile warranty**
- **Full OBD at 1.5\*standard**
- **Clean fuel or significant electric drive**

# CNG



# **CNG Product Availability**

- **Honda Civic**
- **Ford Crown Victoria**
- **Ford F150 Pick-up**
- **Dodge 2500 Van**

# **CNG - Features**

- **Range of products**
- **CNG storage at 3,000 - 3,600 psi**
- **Generally lower range than gasoline**
- **Issues with CNG refueling infrastructure**
- **Mostly fleet vehicles**
- **Demand is largely driven by EPA Act**
- **~\$3,000 price premium**
- **Certified as ILEV, HOV eligible**



# Hybrids



# **HV Product Announcements**

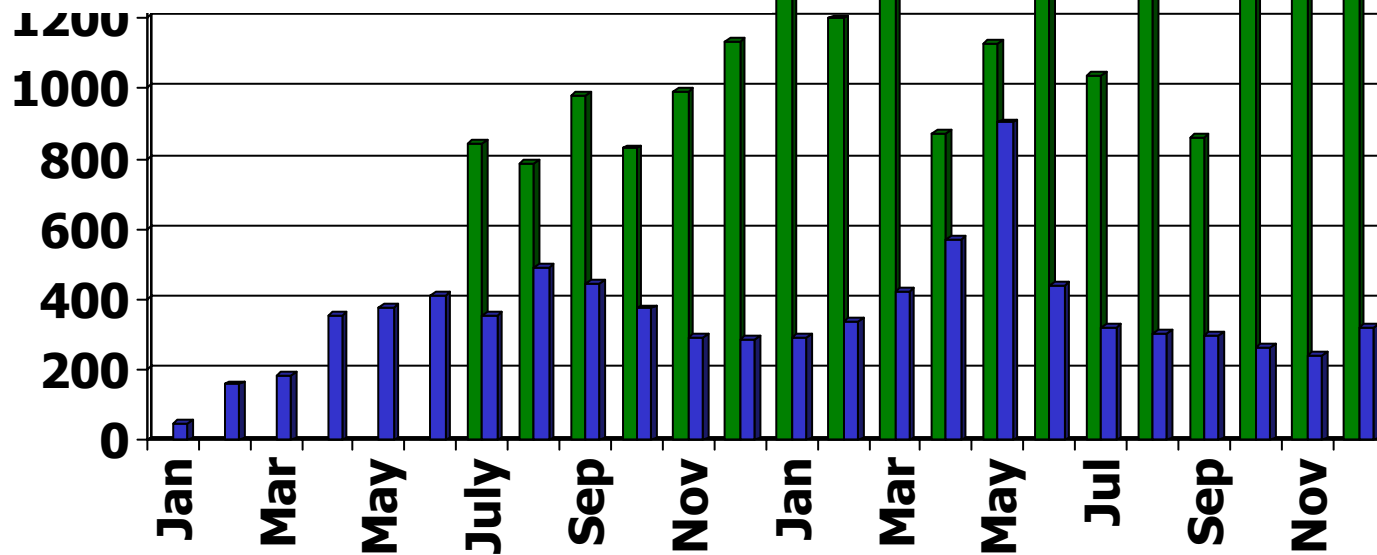
- **Toyota Prius - On sale 12/97 (Japan), 7/00 (US)**
- **Honda Insight - On sale 12/99**
- **Nissan Tino - On sale 2000 (Japan) limited**
- **Toyota Estima - On sale 6/01 (Japan)**
- **Honda Civic - on sale 12/01 (Japan), 3/02 (US)**
- **Ford Escape - 2003 CY**
- **GM ParadiGM - 2004 MY (Not an ATPZEV)**
- **Dodge Durango - 2004 MY**

# Prius and Insight Sales

## Total US Actual Sales

**Insight: 8,514 units**

***Prius: 21,118 units***



**■ Toyota Prius      ■ Honda Insight**

# Prius Attributes

- **52 mpg - City**
- **45 mpg - Highway**
- **SULEV**
- **0-60 mph ~12.5 seconds**
- **4-door, 5-passenger**
- **More interior space than Corolla**
- **Tight turning circle for city maneuvering**
- **Higher seating position**
- **8 year / 100,000 mile hybrid system warranty**
- **\$19,995 + shipping**

# Insight Attributes

- **ULEV Manual Transmission**
  - **61 City**
  - **68 Highway**
- **SULEV CVT**
  - **57 City**
  - **56 Highway**
- **All Aluminum Body**
- **3 year / 36,000 mile hybrid system warranty**
- **\$21,280 w/CVT and A/C**

# Reformer Fuel-Cell Vehicles



# **PZEV Vehicles - Bronze**

- **SULEV tailpipe emissions**
- **Zero evaporative emissions**
- **150,000 durability demonstration**
- **150,000 mile warranty**
- **Full OBD @ 1.5\*standard**

# Gasoline PZEV





# PZEV Challenges

- **SULEV tailpipe emissions**
  - New catalysts, more precious metal
  - Cold start driveability issues
- **Zero evaporative emissions**
  - New systems and materials
  - Packaging issues
- **150,000 durability demonstration**
- **150,000 mile warranty**
  - Possible cost increases
- **Full OBD @ 1.5\*standard**
  - Seriously diminishing returns