Hydrogen Powered Vehicles
Pathways and Challenges

Ross Witschonke
Vice President
Ballard Power Systems
Light-Duty Fuel Cell Power Train

DaimlerChrysler Necar 5
Pathways

The Four Elements of Success

- Auto Companies work with Fuel Cell Developers for cost effective solutions
- Fuel Industry provide a viable fuel infrastructure
- Government develop financial incentives and set standards
- Coordinate for complimentary activities
Electric Drive Train

Co-axial design for battery electric vehicles (Ford Ranger)
Transportation Field Trials

- **Passenger cars**
- There are 18 fuel cell vehicles powered by Ballard® fuel cells
- **Buses**
- Previous trials in Chicago, Vancouver and Palm Springs
- 30 buses in 10 European cities starting in 2002
- Other trials planned for Australia and California
Fuel Infrastructure

- **Multiple Sources**
  - Hydrogen can be produced from natural gas, electricity, and methanol

- **History On Our Side**
  - 1921  12,000 Gasoline Stations
  - 1929  143,000 Gasoline Stations

- **Demand Drives Infrastructure**
  - All major hydrogen suppliers waiting for boom
  - Infrastructure will grow from Centers-Of-Use
California Fuel Cell Partnership - Preparing The Future

- **Co-founded in 1999 by:**
  - Ballard, State of California, major auto-manufacturers and energy companies.

- **Currently has 19 partners and 9 associate partners**

- **Mission:**
  - Demonstrate / test Fuel Cell vehicles
  - Investigate fuel infrastructure issues
  - Promote public awareness of PEM Fuel Cell vehicles
  - Identify potential solutions to barriers to commercialization

- **Demonstrations**
  - The Partnership will place more than 70 fuel cell vehicles (cars and buses) on the road between 2000 and 2003

(Source: California Fuel Cell Partnership)
Government’s Challenges

■ Funding
  • Advanced materials development
  • Demonstration programs

■ Tax Incentives
  • Tax credits for rapid market penetration

■ Standard Setting
  • Global Standards for engine and vehicle
  • Develop codes for refueling stations and service centers
What we need to do

- Continue to reduce costs
- Accelerate fuel infrastructure development
- Continue to validate reliability, durability, codes and safety standards
- Combine efforts for better overall solutions
- Promote partnerships to develop technology, products and market opportunities.