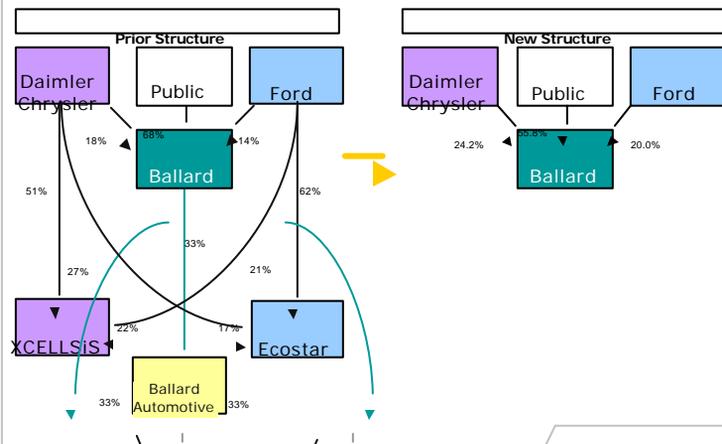


Fuel Cell Technology in Transportation Applications

Presented by Bruce Rothwell
Sales Manager - Heavy Duty

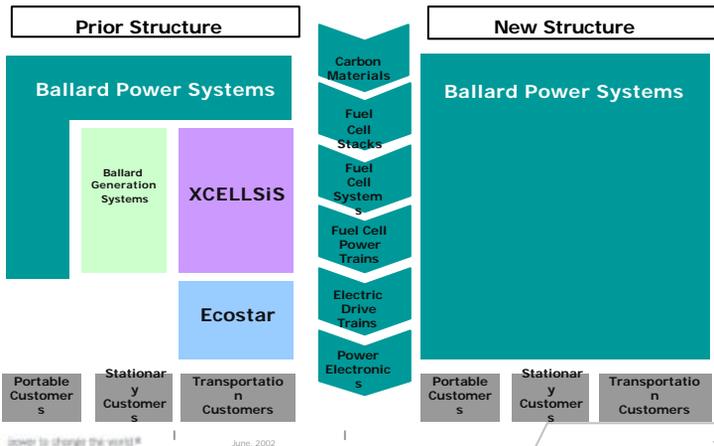
June, 2002

Ballard Today - Streamlining our Structure



Streamlining our Operations

BALLARD



Global Locations

BALLARD



Customer and Market Focus

BALLARD®



Power to change the world®

June 2002

5

Ballard Power Systems

BALLARD®

TRANSPORTATION DIVISION



Transportation Division

BALLARD®

- Ballard's Transportation Division works with many of the world's leading auto manufacturers to develop the next generation of efficient and clean engines for the world's fuel cell vehicles.

Mark 902 Fuel Cell Power Module

Ballard's most advanced fuel cell platform to date



- 85 kW (continuous maximum power)
- Increased reliability
- Lower cost
- Increased power density
- Increased compatibility with customer system requirements
- Unique flow field plates
- Capability for volume-manufacturing

power to change the world®

June, 2002

7

Ballard® Light-Duty Fuel Cell Engines

BALLARD®



Xcellsis™ HY-75



Xcellsis™ ME-75



Ford Focus FCV



DaimlerChrysler
Jeep Commander 2

power to change the world®

June, 2002

8

Ballard® Heavy-Duty Fuel Cell Engine

BALLARD®



Xcellsis™ HY-205



ZEBus



Otis Fuel Cell
Urban Transit Bus

power to change the world®

June, 2002

9

Auxiliary Power Unit

BALLARD®



- Ballard offers small fuel cell systems or auxiliary power units (APUs) to supply a vehicle with clean, efficient onboard electricity.
- This electricity can be used to power:
 - Air conditioning systems
 - Mobile office equipment
 - Refrigeration systems
 - Microwave ovens
 - Televisions and VCRs



power to change the world®

June, 2002

10

Transportation Prototypes

BALLARD®

- Passenger vehicles
 - 25 fuel cell vehicles demonstrated to date using Ballard® fuel cells
- Buses
 - 12 fuel cell buses demonstrated to date using Ballard® fuel cells
 - Previous trials in Chicago, Vancouver and Palm Springs
 - 30 buses in 10 European cities starting in 2003



power to change the world®

June, 2002

11

California Fuel Cell Partnership - Preparing The Future

BALLARD®

- Co-founded in 1999 by:
 - Ballard, State of California, major auto-manufacturers and energy companies
- Currently has 20 partners and 9 associate partners
- Mission:
 - Demonstrate vehicle technology
 - Demonstrate alternative fuel infrastructure
 - Explore the path to commercialization
 - Increase public awareness
- Demonstrations
 - The Partnership will place more than 70 fuel cell vehicles (cars and buses) on the road between 2000 and 2003



West Sacramento, California



Source: California Fuel Cell Partnership

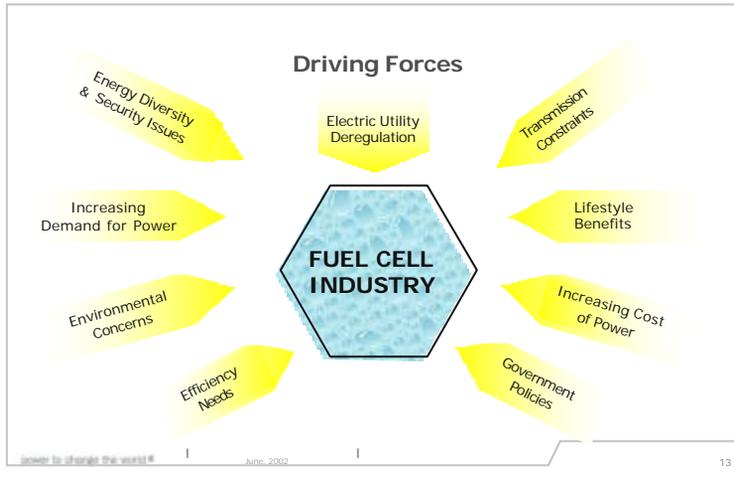
power to change the world®

June, 2002

12

The Time is Now for Fuel Cells

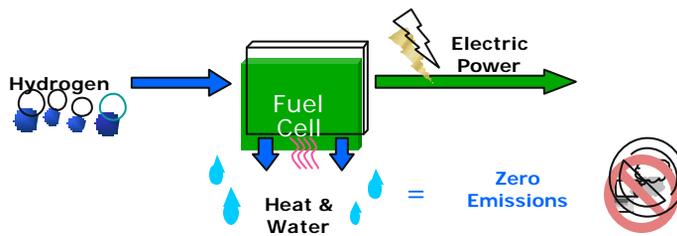
BALLARD®



Fuel Flexibility

BALLARD®

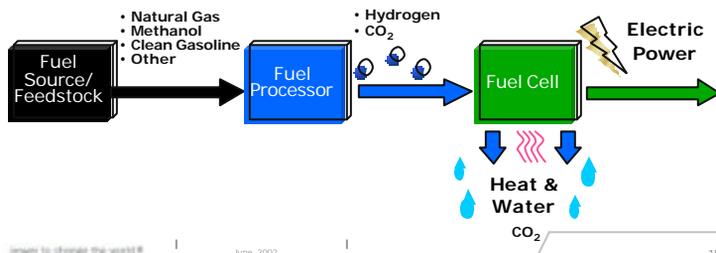
- Ballard® fuel cells support a variety of fuels based on requirements.
- Continue to provide fuel cell solutions that meet our customers' needs.
- Ballard® fuel cells have operated on various fuels including hydrogen, methanol, natural gas, propane and butane.
 - Hydrogen as the fuel source achieves true "zero-emissions" quality



Fuel Flexibility

BALLARD

- Hydrogen can be extracted from hydrocarbon fuels
 - Based on advanced fuel processor technologies the emission of pollutants like NO_x , PM, CO is zero
 - The emission of CO_2 is significantly lower compared to combustion engines (proportional to the conversion efficiency)



power to change the world®

June, 2002

15

Fuel Cell Commercialization

BALLARD

What we need to do:

- Public Education
 - Hydrogen safety
 - Public awareness of fuel cell technology
 - Communicate environmental benefits
- Continuous improvement of reliability and durability
 - Public field trials
- Validate codes, safety and permitting/siting standards
- Continue involvement with California Fuel Cell Partnership
- Cost reduction
- Fuel infrastructure
 - Hydrogen production, distribution/infrastructure and storage must be developed

power to change the world®

June, 2002

16



The Future

"...and what will men burn when there is no more coal? Water. Yes, my friends, I believe that one day water will be employed as a fuel, that hydrogen and oxygen that constitute it, used singly or together, will furnish an inexhaustible source of heat and light."

Jules Verne, *The Mysterious Island*, 1874

"...fuel cells will finally end the 100 Year reign of the internal combustion engine..."

Bill Ford, Chairman, Ford Motor Company (January, 2000)

Thank You

**Please visit us at
www.ballard.com**