


<b>DOE Hydrogen Program Record</b>		
<b>Record #:</b> 5036	<b>Date:</b> April 20, 2006	
<b>Title:</b> Fuel Cell Stack Durability		
<b>Originator:</b> Valri Lightner		
<b>Approved by:</b> JoAnn Milliken	<b>Date:</b> May 22, 2006	

**Item:**

Over the past several years, the durability of the fuel cell stack has doubled.

**Supporting Information:**

Fuel cell and component developers, supported by the DOE program (through the FreedomCAR and Fuel Partnership, which includes DOE, USCAR, and the five major U.S. energy companies), have developed fuel cell components having improved performance and durability. These improvements have been demonstrated in fuel cell stacks built by industry having double the lifetime - from 1,000 hours to 2,000 hours over the past two years.

These results have been independently verified by Ballard, a fuel cell developer/supplier owned by Ford and DaimlerChrysler, who reported an improvement from 700 hours in 2003 to over 2000 hours in 2005. See [http://www.ballard.com/be\\_informed/fuel\\_cell\\_technology/roadmap](http://www.ballard.com/be_informed/fuel_cell_technology/roadmap).

Caveat: This comparison of improvement is measured on fuel cell stacks (not fuel cell systems in vehicles). Fuel cell durability in vehicles is normally less than that achieved on test stands.

Fuel cell system durability needs to improve to 5,000 hours to compete with conventional technology.

*The text and chart from the Ballard webpage (retrieved May 22, 2006) are pasted below:*

“Ballard’s Technology “Road Map” highlights the automotive fuel cell performance targets Ballard plans to meet over the next five years. The “Road Map” is the yardstick by which Ballard’s performance will be measured, year over year, as the company progress toward its goal of developing commercially viable automotive fuel cell stack technology by 2010.

As with any emerging technology, until recently, the fuel cell industry had no established technology benchmarks or milestones against which to measure progress. However, the US Department of Energy (US DOE) recently updated its Hydrogen, Fuel Cells and Infrastructure Technologies

Program's Multi-Year Research, Development and Demonstration Plan, written in 2003, laying out industry targets for fuel cell cost, durability and performance.”

*Also, from their website:*

“For tomorrow’s consumer of fuel cell powered vehicles, durability means delivering the same level of performance and reliability they expect from today’s internal combustion technology. Ballard has already demonstrated, using real drive cycle testing, more than 2,000 hours of durability in technology demonstration, equivalent to 100,000 kilometers under regular driving conditions.

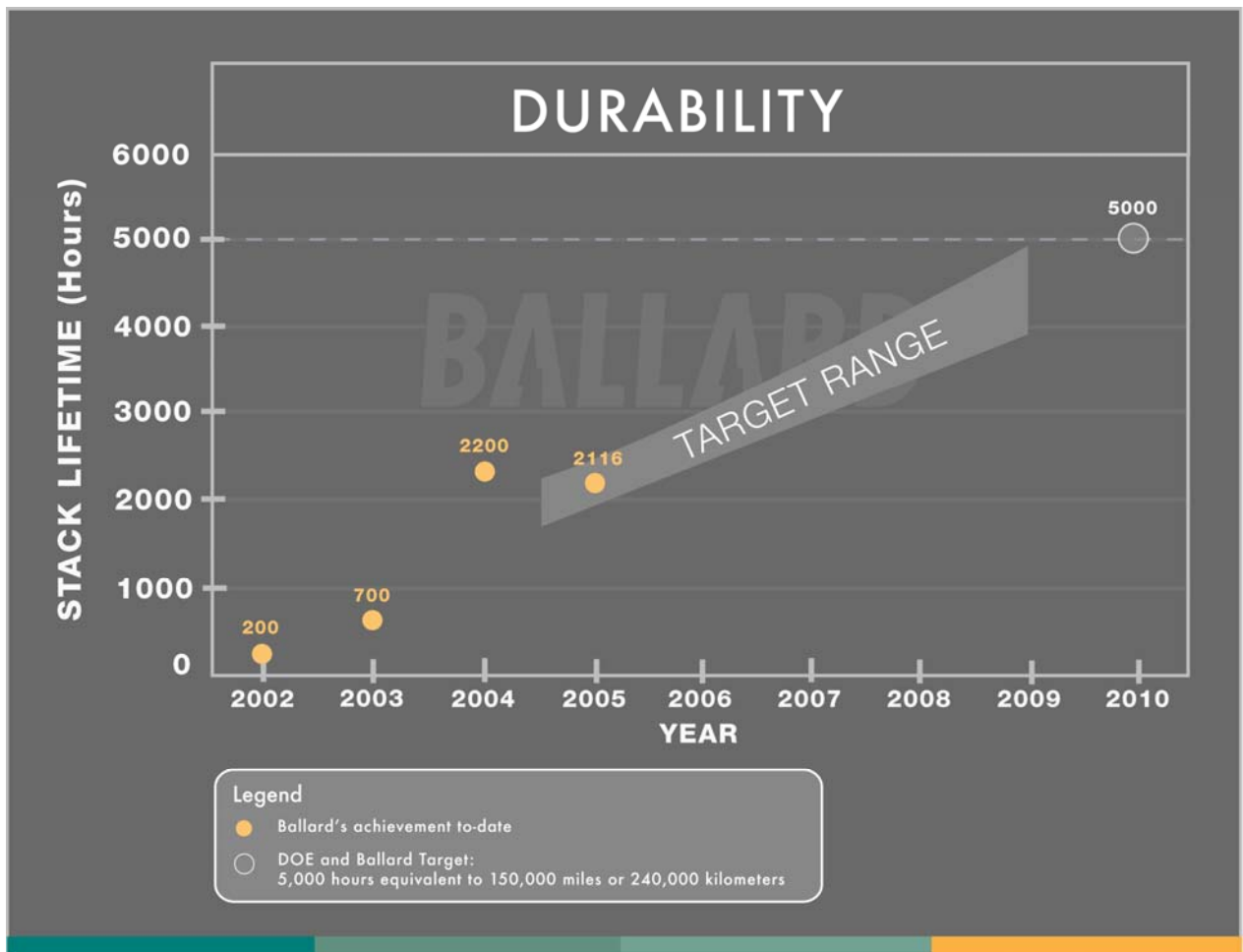
**2005 Road Map Achievements:**

**Durability:** 2,100 hours

**Freeze Start:** -25°C in 90 seconds

**Power Density:** 1,470 watts net/liter

**Cost:** \$73 USD/kW [see notes (1) and (2) below]



(1) Ballard engaged TIAX LLC to conduct an external audit of Ballard's 2005 Road Map cost estimate. Based on the design and performance information provided by Ballard, TIAX has determined that Ballard's stack cost estimate for 2005, as stated in the release, is a reasonable high volume manufacturing cost estimate. TIAX is a leading product and technology development firm, also engaged by the National Renewable Energy Laboratory/DOE in its 2005 assessment of automotive PEM fuel cell costs.

(2) Cost reflects updated methodology, and assumptions consistent with the U.S. Department of Energy (DOE) fuel cell technical target. The 2005 cost estimate represents a 10% reduction in cost from 2004, whether calculated using the new or former methodology.