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Subcommittee on Energy and Mineral Resources

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Mr. Chairman, Members of the Committee, my name is Chris Guzy and I am the Chief Technology Officer of Ballard Power Systems. Thank you for the opportunity to speak to you today on the subjects of platinum and fuel cell commercialization.

The purpose of my testimony is to provide the Committee with an understanding of the use of platinum in fuel cells; outline Ballard's Technology Road Map for achieving key technical targets that underpin the commercialization of automotive fuel cell technology; and review the important role that platinum plays within this framework. I will also offer a set of steps the government can take to support fuel cell commercialization in the context of the technology's platinum use.

Ballard is recognized as a world leader in developing and manufacturing proton exchange membrane or PEM fuel cells. We've been developing PEM fuel cells since 1983 and hold nearly 1,000 patents, issued and pending, on some of the most fundamental fuel cell intellectual property.

We are the exclusive supplier to Ford and DaimlerChrysler and have supplied fuel cells to many of the world's other major automotive manufacturers. Today, Ballard fuel cells power more customer demonstration vehicles than all other fuel cell developers combined. As well, our state of the art manufacturing facility provides volume production capability that is unmatched in the industry.

It is from this leading position that we join with many others in the firm belief that hydrogen fuel cells will be the powertrain of the 21 st Century. Fuel cells have the power to transform our world because they offer a comprehensive solution to some of the most pressing problems of our time: energy security, global climate change, urban air quality, and long-term energy supply.

In addition to automotive applications, Ballard is actively working with partners and lead customers to develop fuel cell powered products for residential cogeneration, forklifts, and back-up power. Each of the applications present less challenging cost requirements than automotive and are on a nearer term path to commercialization. These early markets will help facilitate the transition to fuel cell vehicles by, among other contributions, growing the PEM supply base and establishing early hydrogen infrastructure. It is interesting to note that the relative contribution of platinum to cost in these applications is less significant than in automotive—a function of the fact that lower production volumes generate higher costs in other areas, such as stack assembly. However, given that the largest potential fuel cell application is the automotive market, and that the relative contribution of platinum to cost is higher in automotive fuel cell applications, that is where I will focus my remarks today.

To help guide and communicate our progress toward the demonstration of commercially viable automotive fuel cell technology by 2010, two years ago Ballard began publishing a Technology Road Map. This Technology Road Map is fully aligned with the Department of Energy's (DOE) published commercial targets for automotive fuel cells and focuses on the key factors of cost, durability, freeze-start, and power density.

Let me first address cost. Meeting the DOE's 2010 high volume stack cost target of $30 per kW is required for fuel cells to compete with today's internal combustion engines. Over the past 4 years, we've consistently achieved significant cost-reduction targets and are confident we will meet this important goal. Between 2002 and 2005, the projected high volume cost of Ballard's automotive stack technology has been reduced from $125/kW down to $73/kW. In 2006, our target is to reduce the cost to <$65/kW.

The impact of the platinum catalyst on overall fuel cell stack cost is significant. A fuel cell consists of bipolar plates to carry the reactant gases, an electrolyte membrane, and two catalyst-coated electrodes. Platinum is required on both electrodes, and is core to achieving the required levels of fuel cell performance.

Accordingly, a major thrust of our cost reduction strategy has been to lower the platinum loading in our fuel cells. Between 1994 and 1999, Ballard achieved a tenfold reduction in platinum loading. We did so by switching from non-supported pure platinum catalysts to carbon-supported catalysts with increased platinum surface area to provide more accessible active sites for the fuel cell electrochemical reaction. We improved fuel cell performance over this same period, despite the lower amounts of platinum, through improved catalyst utilization, optimized cell design, and implementation of better materials.

Since 1999, we've achieved a further 40% reduction in catalyst loading while continuing to improve fuel cell performance. The path to meeting the 2010 cost target requires an additional 50% reduction in catalyst loading from where we are today. Early laboratory demonstrations give us confidence that we will achieve this goal.

To get a sense of the relative contribution of platinum to the overall cost of the fuel cell, one should note that even with the low catalyst loadings targeted for 2010—about 30 grams —a fuel cell capable of delivering 100 kW gross power (or roughly 130 horsepower) will still contain up to $1000 of platinum at today's prices, representing approximately 30% of the total stack high volume cost. This is 5-10 times higher than the amount of catalyst that is found in a conventional autocatalyst today.

As we work to lower platinum catalyst loadings, we must be careful to balance this objective against durability requirements, another key commercialization parameter. Last year, while aggressively pursuing lower platinum loadings, we were still able to achieve an automotive fuel cell stack lifetime of 2,100 hours and are confident that by 2010 we will deliver on the DOE target of 5,000 hours—which is equivalent to the lifetime of today's internal combustion engine. To put this goal in perspective, our cogeneration system for residential use in Japan — while operating under less rigorous duty cycles than the automotive application — has achieved more than 10,000 hours of lifetime.

- In addition to our progress toward cost and durability objectives, we are improving the ability of our fuel cells to start in freezing temperatures and are on track to exceed the DOE target for 2010. The electrochemical reaction within a fuel cell produces water and heat. Managing that water in sub-zero temperatures is essential to a successful start-up. Last year, we demonstrated technology that was able to start at –25 ° Celcius, reaching 50% of the rated power within 90 seconds, which represented a much faster time than our 2005 goal of 150 seconds. Our goal for 2010—which is more stringent than the DOE target—is to demonstrate start-up from –30 ° Celcius, reaching 50% of the rated power in 30 seconds.

Lastly, power density is an important criterion to ensure that fuel cells can be packaged within the limited vehicle space available. Last year, we demonstrated fuel cell technology at 1470 watts net per litre. The DOE's 2010 commercial target is 2000 watts net per litre. As with freeze-start capability, Ballard has set a more stringent target based on our customers' requirement s of 2500 watts net per litre and we're confident we can achieve this target through improved stack polarization performance and advanced cell designs. .

- To summarize: we know what the technical challenges are, we have multiple technology paths that we are pursuing, and we are confident that we will demonstrate commercially-viable automotive fuel cell technology by 2010. As discussed, platinum will continue to play a pivotal role in the commercialization of automotive fuel cell technology. That said, we are in agreement with the conclusion that our colleagues at TIAX have reached in their DOE-commissioned analysis "Platinum Availability and Economics for PEMFC Commercialization"— the availability of platinum at a stable price should not be a barrier to fuel cell vehicle commercialization.

In closing, I'd like to recommend three important steps Congress can take to support fuel cell commercialization as it relates to platinum.

- First, Congress should provide fuel cell R&D funding at levels authorized in the Energy Policy Act of 2005 to: (a) increase public-private research efforts to reduce platinum loadings while simultaneously improving fuel cell performance; and (b) increase public-private research efforts aimed at the development of non-precious metal catalysts to replace platinum. With respect to the latter, many of the alternative catalysts being investigated today are cobalt based, which offer a lower cost catalyst, but to date require a tradeoff of reduced performance and durability. Accordingly, we believe that while the substitution strategy is a good approach for the long-term, we do not see non-precious metal catalysts offering a viable alternative at the point when fuel cells begin the transition to market.

Second, Congress should investigate whether and what government actions may be necessary to ensure a proper platinum recycling framework is in place to support fuel cell vehicle commercialization.

- Third, Congress should legislate a meaningful set of legislat a meaningful set of tax credits for fuel cell vehicles for a 10-year period beginning early in the in the next decade. These tax credits—which should be phased (decreasing in value over time)—will help to mitigate the short-term increase in platinum prices in that can be expected to occur as supply adjusts to response tonew demand.
- Thank you for the opportunity to appear before you today. I look forward to any questions you may have.

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