**UTC Power Comments Regarding the California Air Resources Board (CARB) Zero Emission Bus Requirement**

**July 22, 2008**

UTC Power greatly appreciates the efforts of the California Air Resources Board (“CARB”) members and staff to implement California’s zero emission bus regulation.

We have been involved in zero emission fuel cell bus applications since 1998 and our fuel cell power systems have provided propulsion for buses deployed in two locations in California, plus Washington, DC, Spain, Italy, Belgium and Hartford, CT. These buses have demonstrated the feasibility of fuel cells in real-world transit bus applications by running in transit company revenue service for over 320,000 miles and over 31,000 hours of operation.

We believe the existing zero emission bus regulation should be preserved. However, we recognize that changes in timing of the rule may need to be considered to reflect the status of demonstrations as a whole, the progress toward fuel cell commercialization, the ability of the industry to respond to substantial increases in demand in the near term and the need to deploy fueling and maintenance infrastructure to support a substantial increase in fleet size. Fleet performance has clearly demonstrated that fuel cells in transit bus applications are capable of meeting the demanding requirements of the transit bus market. Near term areas for improvement include both battery technology and hybrid drive system power management. Both are necessary for any hybrid or electric drive system deployment and the fuel cell combination will provide the best near term zero emission solution.

Fuel cell availability (defined as a percent based on the number of actual service days divided by the total number of service days possible, assessed daily) is on track to meet commercial requirements. Our performance data indicates an achievement of 95% availability of the fuel cell itself, meeting commercial targets for the fuel cell power system. The UTC Power fuel cell hybrid buses, in total, have been steadily improving and are currently indicating 70% availability. This covers all systems and components on the bus from fuel cells and batteries to mirrors and doors. This is less than the 85% availability goal desired by transit agencies and is primarily due to early generation designs of batteries and system integration. The battery and systems integration issues have been addressed in the design for future buses, the first of which will be delivered later this year. While these metrics have been and will continue to be tracked with the current fleet of six buses that have been in revenue service since 2006, the new generation of buses should demonstrate the fleet availability goal of 85%.

The current demonstration zero emission buses in service in California have demonstrated fuel economy significantly better than diesel, compressed natural gas (“CNG”) and hydrogen internal combustion engine (“HICE”) buses when measured on an energy equivalent basis. The Department of Energy’s National Renewable Energy Laboratory (NREL) has been reporting statistics since 2006 and has documented that the three fuel cell buses at AC Transit average 7.04 diesel equivalent miles per gallon (mi/dge) compared to the AC Transit diesel fleet (operating in the same environment) average of 4.20 mi/dge. NREL has also documented that the one bus at Sunline Transit in Palm Springs averages 8.13 mi/dge compared to 3.37 mi/dge for CNG and 4.90 mi/dge for HICE. The higher mileage at SunLine is a result of the route structure and duty cycle which is different than that at AC Transit. This equates to fuel cell hybrid buses offering a fuel economy improvement of 68% over diesels, 141% over CNG and 66% over HICE systems, respectively.

Since we last addressed CARB in 2006, UTC Power has made over a 300% improvement in durability (life) of the fuel cell measured in hours of operation. This is a significant advancement towards commercialization that will enable life cycle cost reduction in the commercial market. These improvements are a direct result of the investment by UTC Power and its fuel cell bus partners (including the transit agencies) and the demonstration buses in revenue service. These demonstration programs have provided “real world” operational data and valuable feedback that identifies areas for further improvement and serves as the foundation for subsequent generations of technology.

The technology development process is dynamic and government regulations need to reflect this reality to ensure the maximum opportunity for support and adoption. It is for this reason that it is extremely important for California to continue to support more demonstration bus deployments to provide validation support for additional technology and cost improvements. The next generation of zero emission buses will begin running in CA in late 2009 with our program partner AC Transit.

We believe the zero emission bus purchase requirement contained in the regulations should be preserved, but with a slightly extended and phased approach. UTC Power’s proposed timetable takes into consideration the introduction of next generation technology later this year, a year’s worth of performance data from these new demonstrations and the opportunity to incorporate any learning in the next commercial offering. Data from the year of monitored operation from these new demonstrations should form the basis for the analysis and triggering of the purchase requirement.

The purchase requirement is recommended to step from an initial 5% to a 15% requirement two years later, as a gradual introduction of zero emission fuel cell buses into the fleets of California transit authorities to accommodate transit company purchase cycles and lead times. This allows equipment providers and their suppliers to increase volume in an orderly fashion. It also expands the number of buses in revenue service in the near term, providing greenhouse gas emission reduction benefits immediately. Creating an interim step also provides a more gradual path to the commercialization goals as expressed in terms of cost, durability and reliability. UTC Power supports this approach and the following implementation criteria, timetable and purchase levels:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Purchase Requirement | Date for buses on the road | Cost per bus | Durability | Reliability(Miles between Propulsion Related Road Calls |
| 5% | January 2013 | $1.75M | 10,000 hrs. | 8,000 miles |
| 15% | January 2015 | $1.25M | 20,000 hrs. | 10,000 miles |

We support the proposed process to determine purchase requirements based on performance characteristics (such as cost, durability and reliability) and recommend that the comparisons of life cycle costs include a comparison of zero emission buses with diesel, diesel-electric hybrid and electric trolley buses based on an average bus life of 12 years. UTC Power believes that the timetable, purchase levels, criteria and metrics referenced above are appropriate and realistic. They are based on the state of the technology today, expectations for future gains based on field data experiences, and laboratory simulations and statistical predictions.

The key to a successful zero emission bus program is recognition that the mandate cannot be imposed in isolation. A strategy needs to be developed that aligns the requirements for vehicle deployment with necessary hydrogen infrastructure. It is important that the hydrogen fueling infrastructure keeps pace with the fuel cell bus deployment and financial commitments are encouraged to bring fueling stations on-line at costs approaching commercial levels. UTC Power recommends that fueling infrastructure be appropriately managed to maintain a coordinated approach with the deployment of the fuel cell buses.

UTC Power also believes that incentives should be provided to enable transit agencies to better adhere to the implementation requirements. Other elements of this comprehensive strategy should include federal and state funding for procurement and financial incentives for vehicles and infrastructure as well as public education and awareness. Such incentives would help recognize the value of certain attributes of the fuel cell buses where the associated costs of non-zero emissions buses may not be reflected in the capital or life cycle cost of the current technology.

There is increased interest in fuel cell bus purchases from around the world. London, Barcelona, Hamburg, Berlin and other European metropolitan areas have already decided to move forward aggressively in the use of fuel cell buses. Fuel cell bus programs have also been announced in China and Brazil to improve air quality.

The eyes of the world are on California. It has led the way in aggressively addressing light duty vehicle emissions and should not compromise by lowering its standards on heavy duty transit buses. Now is the time for California to reaffirm the zero emission bus rule to improve air quality with every fuel cell bus deployed in the near term and to provide the basis for future US technological investment to advance the market readiness for the US and the world.