QUALLION
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Honorable Commissioners,

Quallion appreciates the opportunity to provide comments on the California Energy Commission's 2012-2013 Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program. This program is an important element of California's leadership position on energy and air pollution control, and the program also plays an important role of creating jobs in California in the development and implementation of clean energy technologies.

Quallion would like to encourage the Energy Commission to expand the eligibility for awards in the commercial demonstration category to include vehicle technologies that can reduce unnecessary emissions and fuel consumption from main engine idling. Technologies that reduce or eliminate main engine idling are showing promise as cost effective ways to reduce emissions and conserve fuel, and the support of the Energy Commission can help move these technologies to the commercial market more quickly.

In the heavy duty trucking industry, long duration idling is caused by a need to maintain a comfortable overnight environment for a driver in the truck's sleeper cab. This idling costs fleet operators thousands of dollars per year, per vehicle, in fuel costs alone, plus additional costs in engine maintenance. According to the US Environmental Protection Agency, heavy duty trucks idle six to eight hours per day, up to 300 days per year, equaling over one billion gallons of diesel consumed for idling alone – roughly the same carbon emissions as 1.9 million passenger vehicles. Idling engines produce up to 11 million tons of carbon dioxide, 200,000 tons of oxides of nitrogen, and 5,000 tons of particulate matter nationally each year, with significant public health costs from air pollution.[1] With one million heavy duty trucks on the roads, and 150,000 to 250,000 Class 8 trucks produced in the United States each year, half

[1] US EPA SmartWay Technology Program. http://www.epa.gov/smartway/technology/idling.htm

of which are configured with sleeper cabs, there is a large market potential for this technology to achieve significant fuel savings and emission reductions.

Current idle reduction technologies have significant limitations that have slowed market adoption and implementation. Stationary technologies such as electrified parking spaces have significant capital costs, only yield benefits in the immediate surrounding area, and have limited deployment. Mobile solutions include heating and air conditioning systems powered by diesel auxiliary power units (APU) that still consume fuel, produce emissions, and require regular maintenance. In some cases, these smaller engines are significantly dirtier than the main engines they are seeking to offset.

Battery electric APU systems typically rely on lead acid batteries which have poor cycle life performance and require replacement and disposal of toxic spent batteries every one to two years. Lead acid batteries also fail to provide adequate cooling performance in hot temperatures and often run out of power halfway through the night. The added weight of lead acid batteries reduces the overall fuel economy of the truck and can cut down on the cargo hauling capacity in order to meet federal weight requirements. This added weight reduces truck revenue per load, thereby increasing the total number of truck trips to move a given cargo.

Quallion has developed a novel lithium ion battery electric idle reduction HVAC solution that addresses the shortcomings of these existing technologies by leveraging the company's expertise in lithium ion battery systems. The system is comprised of a high voltage (300V) lithium ion battery pack and a high efficiency electric air conditioning system. Compared to either diesel or lead acid powered systems, the lithium ion powered system is lighter weight, offers increased energy storage for longer runtime and improved cooling performance. The lithium ion battery system requires zero maintenance and has much improved cycle life such that the system is warrantied for five years. This system exploits the inherent advantages of lithium ion battery technology for improved energy density and cycle life, and the inherent efficiency of running an electric air conditioning system at high voltage.

Quallion's prototype idle reduction system was developed with funding from the US Department of Energy and is currently being evaluated by truck manufacturers for inclusion as optional equipment on a future model year truck. Support from the California Energy Commission could demonstrate the system's performance in real world operations with fleet operators, and increase the available data to support widespread market adoption, leading to increased fuel savings and avoided emissions in the State of California.

One of the challenges of bringing a lithium ion battery system to market is the high initial cost compared to cheaper lead acid batteries, but this cost is more than offset by reduced operating costs. A smart fleet operator will look past the initial cost and consider the total cost of ownership for a vehicle technology. Quallion estimates that its roughly $9,000 system will pay for itself in two years, based on

idling fuel savings alone.[2] This does not include additional savings from reduced maintenance and truck downtime, fuel savings due to reduced battery weight, or increased cargo payloads. While the overall cost analysis for the technology is compelling, the technology would benefit from additional government funded support to demonstrate the reduced operating costs in a real world environment.

Accordingly, Quallion recommends inclusion in the 2012-2013 Investment Plan of programs that provide grant funding for commercial demonstrations of lithium ion battery powered idle reduction systems. Such a demonstration program would help generate real world data about the performance of the system and provide a low risk way for fleet operators to begin integrating lithium ion battery systems into their California fleets. Previous AB118 programs have funded commercial demonstrations for battery and hybrid electric vehicles that rely on advanced batteries for motive power, but they have not included idle reduction systems in their scope of eligible technologies. Due to the significant fuel consumption and air pollution caused by heavy duty vehicle idling, the 2012-2013 Investment Plan should provide funding for technologies to address this problem. Additionally, Quallion recommends that funding programs be prioritized for California companies to help develop the state's base of manufacturers and clean energy technology firms.

There are a variety of other applications for lithium ion battery electric APU systems beyond overnight idling of Class 8 trucks. Commercial trucks often idle when making deliveries or completing paperwork during the day - for a truck operator, the truck cab is a mobile office. For trucks calling at the Port of Los Angeles or other intermodal cargo facilities, the truck may wait in line for hours to pick up a load. Many utilities have looked to battery electric systems to reduce fuel used by bucket trucks when in a stationary position to operate the boom. Quallion has also developed similar batteries to provide "Silent Watch" capabilities to military vehicles operating in hostile territory. In military applications, the battery system can provide for heating and cooling as well as power the array of navigation, communication and weapon systems on the vehicle without burning fuel, producing emissions, or generating noise or a heat signature that could give away the vehicle's position to an enemy.

Idle stop-start, in which the battery provides motive power to the vehicle at low speeds, is another large market for this technology outside of the long haul trucking industry. This micro-hybrid application also requires the electrification of additional vehicle systems, and as such presents a larger technical challenge. This application would allow for vehicle to shut off their engines even for short stops, such as transit or school buses when picking up passengers, or while in moving queues at low speed, such as a truck calling at an intermodal cargo facility, or even when stuck in slow moving traffic. This idle stop/start technology is an extension of the basic lithium ion battery system for stationary idling.

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[2] Assumes diesel fuel cost of $4.00 per gallon, main engine idling of 6 hours per day 250 days per year, and a fuel consumption of .75 gallons per hour for main engine idling. Assumptions based on: Gaines, et al. *Estimation of Fuel Use by Idling Commercial Trucks.* Center for Transportation Research, Argonne National Laboratory. 2006. http://www.transportation.anl.gov/pdfs/TA/373.pdf

Thank you for your consideration of Quallion's comments regarding the 2012-2013 Investment Plan. We look forward to working with the Energy Commission to reduce fuel consumption, improve air quality, and create quality jobs in California by advancing clean vehicle technologies.

Regards,

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