

Balqon Lithium-Ion Battery Demonstration

Technology Manufacturer
Balqon Corporation

Co-Participants
Port of Los Angeles



Background

The Balqon Lithium-Ion Battery Demonstration project was a follow-on project to the Balqon Electric Terminal Tractor Demonstration TAP project completed in 2008. During this earlier project, the Port of Los Angeles TAP and the SCAQMD partnered to demonstrate a Class 8 electric truck for port drayage operations.

Project Objective

The objective of this follow-on project was to evaluate and demonstrate a lithium-ion battery as a technological upgrade to the lead-acid battery pack used in the previous TAP demonstration. The advanced technology lithium-ion batteries were anticipated to provide more than double the vehicle range, without adding additional weight.

Lithium-ion batteries have several important advantages over competing battery technologies. Primarily, lithium is a highly reactive element with very high energy density. The electrodes are composed of lightweight lithium and carbon, offering a much lighter weight compared to other rechargeable batteries of a similar size. Lithium-ion batteries retain their charge longer than other battery chemistries, and exhibit no “memory effect” – some high energy density battery chemistries, such as nickel cadmium, can become degraded if recharged before the battery has been fully discharged. Lithium-ion batteries can be recharged without completely discharging with no battery degradation, and can withstand literally hundreds of charge/discharge cycles, increasing battery lifespan.

Technology Description

Under this demonstration, one electric drayage truck, the Balqon Nautilus Model XE-30, was converted from lead acid battery to lithium battery technology. This zero emission all-electric drayage truck was designed to transport containers in terminal or on-road and carry loads up to 100,000 lb. with a range of 100 miles on a single charge.



The lithium battery cells were assembled into the battery packs at Balqon’s Harbor City, California facility and fitted with a proprietary battery management system (BMS) specifically designed for lithium-ion battery chemistry and characteristics. This TAP project also supported development of new charging algorithms to allow fast charge the lithium-ion batteries using the existing Balqon fast charger. Vehicle range tests were conducted using both dynamometer and field test

protocols. Installation of lithium batteries was expected to increase range by a factor greater than two as compared to the lead acid battery-equipped vehicle. It was anticipated that unloaded range would increase to 180 miles on single charge. Range at a loaded weight of 60,000 pounds at 45 miles per hour during short haul drayage was expected to exceed 100 miles on a single charge.

Results

In June 2009, Balqon completed assembly of a Nautilus E30 all-electric tractor retrofitted with lithium ion battery packs. A one-day demonstration of the Nautilus E30 confirmed a range of over 150 miles on a single charge with unloaded conditions at 80% depth of discharge. The new lithium-ion battery packs included Balqon's BMS, which allows batteries to be fast charged and self-equalize during idle operation. It is noteworthy that the lead-acid battery system provided 30 to 50 mile range under comparable test conditions.

Balqon upgraded the Port's Nautilus E30 tractor with additional lithium-ion battery capacity and completed a preliminary demonstration, which included several round-trips from a near dock rail yard to Port terminals.

Benefits

Zero-emission drayage trucks provide significant environmental benefits. However, operational concerns regarding range and charging times limit the applicability of zero-emission technology for the dray industry. Completion of this advanced battery demonstration project supports the long-term goal of increasing the use of zero-emission electric truck technologies in the drayage truck sector.

Project Costs

The total project cost was \$940,000. The Port of Los Angeles, under TAP, contributed \$400,000. Balqon Corporation provided the two vehicles as well as additional in-kind engineering and test resources; the Balqon contribution was valued in excess of \$540,000.