



## Supercharging The Vehicle Battery Space

Law360, New York (October 15, 2010) -- This summer, the U.S. Department of Energy released a new report highlighting the benefits of the American Recovery and Reinvestment Act of 2009 for the advanced battery and electrical vehicle industries.

The report, "Recovery Act Investments: Transforming America's Transportation Sector," states that the Department of Energy has spent more than \$5 billion in grants and loans on electrifying the transportation sector. The intervention of the U.S. government in the advanced vehicle battery space represents a significant catalyst for the industry and has the potential to reshuffle the competitive deck.

However, notwithstanding this substantial funding, challenges remain which can provide opportunities to those contributing to the development of this industry.

Under the Recovery Act, the U.S. government set aside \$2.5 billion to support electrical vehicle development. The Recovery Act included \$2.4 billion in grants to establish 30 electric vehicle battery and component manufacturing plants — with at least \$1.2 billion earmarked for the expansion of U.S. advanced battery manufacturing capacity.

According to the Department of Energy's report, private capital matched these grants at minimum dollar for dollar. The report stated that construction has begun on all nine new battery plants opening as a result of the Recovery Act investments — four of which will be operational by the end of the year.

In addition, with support of the federal funding, 11 battery component manufacturing facilities will expand their production capacities for separators, a key component in the lithium-ion batteries for electrical vehicles.

Additionally, the Department of Energy's Advanced Research Project Agency — Energy (ARPA-E) program is funding more than 20 research projects to support potentially transformative technologies such as semi-solid flow batteries, ultracapacitors and "all-electron" batteries that could go beyond today's best lithium-ion chemistries.

The federal investments seek to jump start the U.S. advanced vehicle battery industry and expand U.S.-based manufacturing operations for advanced vehicle batteries. According to the Department of Energy report, before the Recovery Act, the U.S. had only two factories manufacturing advanced vehicle batteries and produced less than 2 percent of the world's advanced vehicle batteries, but by 2012, 30 factories will be operational and the U.S. will have the capacity to produce 20 percent of the world's advanced vehicle batteries. By 2015, this share is projected by the report to be 40 percent.

Serious challenges remain, however, to move the industry forward. The major impediments to the continued development of the U.S. advanced battery industry include: battery costs that are too high to allow for the development of a new battery industry, slow consumer adoption of the new technology and substantial market share held by large Asian competitors.

## **The Cost Challenge**

The U.S. Advanced Battery Consortium has set a long-term cost target for lithium-ion battery packs used in electric cars of \$250 per kWh. However, most sources estimate the current cost of an automotive lithium-ion battery pack sold to OEMs at around \$1,000 per kWh.

In an August 2010 filing with the SEC, A123 reported about \$1,300 in cost of revenues for each kWh of product that it shipped in the second quarter of 2010. In May, 2010, Nissan's chief product planner for North America told the Wall Street Journal that Nissan's manufacturing cost for the 24 kWh battery pack used in the Leaf is roughly \$18,000, or \$750 per kWh; and that is without accounting for a markup by an OEM.

Thus, the current costs of a battery are substantially higher than the cost target, and according to a January 2010 study by the Boston Consulting Group, pending a major breakthrough in battery chemistry that increases the amount of energy stored without a commensurate cost increase, the cost target of \$250 per kWh is unlikely to be achieved by 2020.

This presents significant challenges for advancement of the industry. But it also gives rise to the opportunity to address this cost challenge.

## **The Speed of Market Adoption**

Uncertainty from consumer adoption of electrical vehicles has also clouded the industry's growth expectation and financial return. Many expect that the rollouts in late 2010 of the Think City, Chevy Volt, Nissan Leaf and Fisker Karma will be a boost for advanced battery manufacturers.

However, a protracted period prior to entering the mainstream market and even then, a sustained period of gradual adoption of electrical vehicles prior to mass penetration may be likely. Demand for electrical vehicles and the advanced vehicle batteries which they use may be slow to take off due to the higher energy density of oil, the ability to address oil concerns with other alternatives such as biofuels and natural gas and the lack of a reliable electricity grid infrastructure.

The costs of batteries, as discussed above, will impact the cost-effectiveness of electrical vehicles for consumers absent substantial increases in oil or gas prices or government incentive subsidies.

Additionally, driving range is another key concern keeping consumers from buying an electric car. According to the Boston Consulting Group study, without substantial improvement in technology, and even accounting for a possible doubling of energy density in batteries over the next 10 years, batteries will continue to limit the driving range of fully electrical vehicles to 250 to 300 kilometers (about 160 to 190 miles) between charges.

These issues will need to be addressed in order to accelerate consumer adoption.

## **Competition for Share in the Advanced Vehicle Battery Market**

Today, Asian battery manufacturers are leading the way in the advanced vehicle battery space. Most batteries used in hybrid electric vehicles are not U.S.-made. Toyota's Prius uses batteries made in Japan, and Ford's Fusion uses batteries from Japan's Sanyo. A new generation of electric vehicles is also likely to use non-U.S. battery technology.

General Motors will assemble battery packs for its electric Chevrolet Volt in Brownstown Township, Mich., but individual battery cells will be made in South Korea by LG Chem Ltd.

The U.S. government's financial commitment to the advanced vehicle battery industry undoubtedly gives advantages to U.S.-based companies. However, Japan and China have made similar commitments to the battery industry.

Japan has invested more than \$1 billion in its battery companies. A recent McKinsey & Co. study forecasts the Chinese electric auto market will be worth \$220 billion by 2030.

China, attempting to become a global force in the auto market, has been pumping money and resources into developing electric cars and advanced batteries, and there are already plans for electric vehicle charging stations in Beijing, Shanghai and Tianjin, an infrastructure that is critical to getting consumers on board with the new plug-in battery vehicles.

Work will need to be done by U.S. companies to capture market share in the face of existing market leaders and investment made to maintain this lead.

### **Leveraging Government Spending to Seize Opportunities**

Since enactment of the Recovery Act, the U.S. government has committed resources to further the development of the advanced vehicle battery industry. The funding provided by the government is being used to build out manufacturing capability as well as conduct new research. The government has invested these resources as developing this industry and electrifying transportation offers much promise for both energy needs and economic growth.

However, challenges remain to creating a self-sustaining industry. Entrepreneurs who are able to turn these challenges into opportunities should be able to further the evolution of the advanced vehicle battery industry.

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