EXECUTIVE SUMMARY:
Electric Vehicle Batteries
Lithium Ion Batteries for Plug-in Hybrid and Battery Electric Electric Vehicles: Market Analysis and Forecasts

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Section 1

EXECUTIVE SUMMARY

Battery-powered cars as well as hybrid-electric vehicles that also include a gasoline engine have been a part of the automobile industry since its inception. Electric vehicles (EV) powered by lead-acid batteries first appeared in the late 19th century, and in 1899, Dr. Ferdinand Porsche built the “Mixte,” which featured electric motors and a bank of 44 cells of lead-acid batteries.

The success of mass-produced internal combustion engine (ICE) vehicles relegated lead-acid batteries to the reduced role for mainstream vehicles of primarily starting vehicles. In the 1990s, automakers began to bring both hybrids and EVs back to life, with the former having more success than the latter. At the same time, advances in lithium ion (Li-ion) battery technology created a quickly growing market for more energy-dense and lighter-weight batteries for laptop computers, mobile phones, and consumer electronics devices.

The convergence of the automotive industry towards battery power and the engineering of safe and reliable Li-ion batteries will slowly reshape the automotive industry as it moves towards electrification and away from fossil fuels. Pike Research forecasts that the market for Li-ion batteries for transportation will grow from $875.6 million market in 2010 to nearly $8 billion by 2015. The earliest part of the decade will see tremendous growth as dozens of manufacturers will start to meet the anticipated demands of newly electrified vehicles being launched by nearly every major global automotive company. As manufacturing efficiencies improve and access to lithium expands, the cost of Li-ion batteries will fall by half between 2010 and 2015 to less than $500 per kWh (kilowatt hour).

The market for Li-ion batteries will be primarily driven by plug-in hybrid and all-electric vehicles, which require much larger battery packs than hybrids. Battery chemistries that prioritize energy capacity over power density can equally satisfy both the plug-in hybrid electric vehicle (PHEV) and the EV battery segments, enabling vendors to offer products to multiple vendors for multiple models. Hybrid vehicles, which require batteries that primarily provide short bursts of power for acceleration and allow the engine to be turned off when idling, have been served well by less expensive nickel-metal hydride (NiMH) batteries, and this class of vehicles will be much slower to shift to higher cost Li-ion batteries. Ultracapacitors, which provide high-power and low-energy density, will begin to appear in small quantities as complements to Li-ion batteries. As the technology becomes less costly, ultracapacitors have the potential to replace batteries in micro or mild hybrid applications.

Despite the potential to reduce fossil fuel consumption and greenhouse gas (GHG) emissions, and to provide the convenience of home charging, electrified vehicles will continue to be a niche market in the global transportation industry. Even with broad global interest in EVs, less than 2.5% of the world's fleet in 2015 will be driving at least part of the time on battery power only.
Just as Li-ion batteries are relatively untested in real-world transportation applications, plug-in hybrid and all-electric vehicles are an unknown as a mass consumer offering. Automakers that have studied consumer driving habits estimate an average of approximately 33 miles per day. Based on this data, PHEV engineers have focused on designing vehicles with a 30 to 40 mile all-electric range. However, whether or not a broad audience of consumers would be willing to pay 50% or more for a vehicle than can drive most of its miles on battery power is unknown. Battery manufacturers need to prepare for the possibility that consumers will gravitate towards less expensive vehicles with smaller battery packs (for 10 to 20 miles of all-electric power), which has the potential to broaden the electrified vehicle market, but reduces the total amount of batteries required. Conversely, if all-electric vehicles with 80 to 100 mile range are able to satisfy consumer tastes as primary vehicles, a smaller universe of PHEVs may emerge.

The market for Li-ion batteries could grow beyond our current projections if financing programs are developed that can separate the cost of batteries from the vehicle purchase price. Consumer purchasing decisions on fuel efficient vehicles have been greatly influenced by short-term gasoline prices and the upfront cost of the vehicle. A new model that influences consumer perception to consider the annual cost of driving between gasoline and electrified vehicles could increase the attractiveness of electric vehicles.

Regardless of the direction of the electrified vehicle market, the universe of Li-ion battery suppliers is likely to consolidate to a small number of major players that dominate the industry and a handful of much smaller niche companies. A limited number (likely four or fewer) battery chemistries that provide the best mix of performance, reliability, and cost will win out, with others likely to be abandoned by mid-decade.
Asia, which has dominated the global market for Li-ion batteries to date, will also be the global leader in both Li-ion production and consumption in the transportation industry. The governments of China and Japan have pledged to rapidly move their automotive industries towards battery-powered vehicles through aggressive goals for production, creation of charging infrastructure, and incentives for consumer purchases. The Asian Li-ion battery market will surpass $4 billion in 2015, a 53% market share.

Despite the support of the federal government, U.S. battery companies have struggled to gain market share while the Asian battery market for vehicles has taken off. During the past few years, as the U.S. auto market has faded from its former glory, the federal government has amplified efforts to promote domestic electrified/fuel efficient vehicle and advanced battery industries. Billions of dollars were loaned or given to the automotive industry and the battery companies for research and manufacturing. In 2009, consumer incentives for purchasing electrified vehicles were established as the current administration makes an exerted effort to prevent the failure of the U.S. auto industry. The commitment to avoid this "catastrophic" event will shore up the U.S. battery industry through 2012, but a change in philosophy could remove a vital safety net.
Chart 1.2  Li-ion Battery Sales by Region, World Markets: 2010-2015

(Source: Pike Research)
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SCOPE OF STUDY

Pike Research has prepared this report to provide participants at all levels of the electric vehicle market, including vehicle OEMs, suppliers, battery manufacturers, government officials, and fleet managers with a study of the market for battery technologies for light duty vehicles.

Its major objective is to anticipate the emerging market and likely future growth for electric vehicle batteries and the impact on the automotive industry. The report also provides a review of major demand drivers as well as key industry players within the competitive landscape.

The report’s purpose is not to provide an exhaustive technical assessment of the technologies and battery chemistries industries covered, but rather a strategic examination from an overall tactical business perspective. Pike Research strives to identify and examine new market segments to aid readers in the development of their business models. All major global regions are included. The forecast period extends through 2015.

SOURCES AND METHODOLOGY

Pike Research’s industry analysts utilize a variety of research sources in preparing Research Reports. The key component of Pike Research’s analysis is primary research gained from phone and in-person interviews with industry leaders including executives, engineers, and marketing professionals. Analysts are diligent in ensuring that they speak with representatives from every part of the value chain, including but not limited to technology companies, utilities and other service providers, industry associations, government agencies, and the investment community.

Additional analysis includes secondary research conducted by Pike Research’s analysts and the firm’s staff of research assistants. Where applicable, all secondary research sources are appropriately cited within this report.

These primary and secondary research sources, combined with the analyst’s industry expertise, are synthesized into the qualitative and quantitative analysis presented in Pike Research’s reports. Great care is taken in making sure that all analysis is well-supported by facts, but where the facts are unknown and assumptions must be made, analysts document their assumptions and are prepared to explain their methodology, both within the body of a report and in direct conversations with clients.

Pike Research is an independent market research firm whose goal is to present an objective, unbiased view of market opportunities within its coverage areas. The firm is not beholden to any special interests and is thus able to offer clear, actionable advice to help clients succeed in the industry, unfettered by technology hype, political agendas, or emotional factors that are inherent in cleantech markets.
NOTES

CAGR refers to compound average annual growth rate, using the formula:

\[ CAGR = \left( \frac{\text{End Year Value}}{\text{Start Year Value}} \right)^{\frac{1}{\text{steps}}} - 1. \]

CAGRs presented in the tables are for the entire timeframe in the title. Where data for fewer years are given, the CAGR is for the range presented. Where relevant, CAGRs for shorter timeframes may be given as well.

Figures are based on the best estimates available at the time of calculation. Annual revenues, shipments, and sales are based on end-of-year figures unless otherwise noted. All values are expressed in year 2009 U.S. dollars unless otherwise noted. Percentages may not add up to 100 due to rounding.