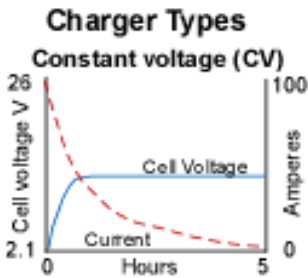


Electric Vehicle Batteries



The electric vehicle battery pack performs the same function as the gasoline tank in a conventional vehicle: it stores the energy needed to operate the vehicle. Battery packs usually contain 10 to 52 individual 6-, 8-, or 12-volt batteries similar to the starter battery used in gasoline vehicles. While a gasoline tank can store the energy to drive 300 to 500 miles before refilling, the current generation of batteries will only store enough energy to drive 50 to 150 miles between recharging.

USABC Battery Performance Goals				
	Energy Density (Whr/kg)	Power Density (W/kg)	Life Cycles per Battery	Cost (\$)
Current Lead Acid	35	150	500	150
USABC mid-term Goals	80	150	600	250
USABC long-term Goals	200	400	1,000	<100
Impact on Vehicle Performance	Range	Acceleration	Life Cycle cost; Replacement Period	Acquisition cost; Battery replacement cost

The range of an electric vehicle (the distance traveled between recharging) depends on the energy stored in the battery pack. Just as the amount of gasoline can be increased by installing a larger gas tank, the amount of stored electrical energy can also be increased by increasing the number and/or size of batteries in the battery pack. However, when batteries are added, the weight is increased and the space used by the battery pack increases. Because of this weight and space penalty, there is a limit to the number of batteries that can be used for any given vehicle.

To increase the range and improve the performance of electric vehicles, batteries are being developed that can store larger amounts of energy with the same weight and volume. The United States Advanced Battery Consortium (USABC) was established to develop the next generation electric vehicle batteries. The members of the USABC include the big three U.S. automobile manufacturers, the Electric Power Research Institute, battery manufacturers, and the United States Department of Energy (DOE).

Performance of Advanced Battery Systems

	Energy Density (Whr/kg)	Power Density (w/kg)	Life Cycles per battery
Advanced Lead Acid	48	150	800
GM Ovonic nickel metal hydride	70	220	600
SAFT nickel metal hydride	70	150	1,500
SAFT lithium ion	120	230	600
Lithium polymer	150	350	<600
Zebra sodium-nickel chloride	86	150	<1000

When the USABC long-term goals (chart, above) are met, batteries will be available to provide electric vehicles with ranges greater than 200 miles and a battery life greater than 100,000 miles.

Independent of the battery development efforts supported by the USABC, the Advanced Lead Acid Battery Association, an association of lead acid battery manufacturers, is supporting development programs to improve the near-term performance of the lead acid battery.

Battery systems being supported by the USABC to meet the midterm goals include nickel metal hydride battery technologies. The USABC is also supporting battery systems to meet the long-term goals. The two systems being investigated are the lithium polymer and the lithium-ion battery systems.