

Batteries for Alternative-Fuel Vehicles

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Introduction:

Batteries are currently one of the main power sources for alternatively fueled vehicles (AFVs), and they are expected to remain so in the near future. Research has been primarily aimed at the performance which a given battery type can deliver at a certain cost. However, studying only the use phase in the life cycle of batteries for AFVs gives a limited picture of the total environmental impact that these batteries may have.

Problem Statement:

If only the use phase is to be considered, then AFVs such as battery-powered vehicles would be declared the cleaner technology when compared with gasoline powered vehicles, since battery-powered vehicles have no emissions at the tail pipe. However, batteries for AFVs use large quantities of toxic and hazardous materials, and these materials must be accounted for when considering the environmental attributes of AFVs. Stages of a battery's life other than the use phase may be responsible for detrimental emissions to the atmosphere.

The entire life cycle of batteries for electric vehicles must therefore be considered. This involves accounting for the materials required for manufacturing the batteries, the manufacturing processes used, the use phase of the battery, and disposal, including recycling. Each stage also has an associated energy demand. If the requirement that 10 percent of the motor vehicles sold in 2003 must be zero-emission vehicles is still to be upheld, this will make materials accounting even more important since the power source for most of these vehicles is likely to be batteries.

Approach:

This research considers battery technologies currently available for use in AFVs or those likely to be used in commercial production in the U.S over the next five years. The performance characteristics for these battery types and current automobile models in production are compared, and the life cycle stages are assessed qualitatively and quantitatively where possible. Environmental impacts in the use from arise from electricity required to recharge batteries. End of life options for each battery system are considered. For some battery types recycling is an option; for others it is only feasible at this point.



Conclusions:

Consideration of the environmental issues for any alternative fuel for AFVs must include studying both emissions from the tail pipe (area mobile sources) and emissions from processes at other stages in the life of the alternative fuel (e.g. stationary source emissions from mining, metal melting operations). Both stationary and mobile sources are important for regional ambient air quality and when considering the environmental benefits or burdens of a given technology.

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