



Battery-in-the-Loop

Evaluation of Batteries in a System Context

Opportunity

Batteries are the most significant technological barrier to commercially viable plug-in hybrid vehicles (PHEVs). The challenge is to develop batteries that are optimized for PHEV operation, while also meeting the market expectations for cost and battery life.

Objective

Engineers in Argonne National Laboratory's Center for Transportation Research developed a Battery-in-the-Loop system to evaluate and benchmark advanced prototype batteries for PHEVs. The system's model-based design approach reduces the development time of battery packs for PHEVs, and solves critical battery and vehicle integration issues.

Argonne engineers use Battery-in-the-Loop to gain insight into the performance, life and cost of advanced battery prototypes. Specific research activities include analyzing and evaluating:

- ▶ The impact of battery parameters on vehicle performance and fuel economy
- ▶ The impact of vehicle parameters on battery use in a vehicle, and relating it to battery life and performance
- ▶ The potential of hybrid energy storage devices (active combination of batteries and ultracapacitors) as a means of overcoming the current shortcomings of lithium-ion battery packs, in a cost-effective manner
- ▶ Battery management systems
- ▶ Performance of the coolant loops under extreme battery use scenarios



Engineer Neeraj Shidore prepares a PHEV battery for testing on Argonne's Battery-in-the-Loop system.

Approach

In the Battery-in-the-Loop system, batteries/modules/cells are connected to a bidirectional power supply that acts as a power source/sink. Researchers control this power supply so the battery behaves as if it were in a vehicle. Using the Argonne-developed Powertrain System Analysis Toolkit (PSAT) and Autonomie simulation software, batteries can be evaluated in a closed-loop, real-battery/virtual-vehicle scenario.

Funding and support for this research is provided by the U.S. Department of Energy's Office of Vehicle Technologies under Lee Slezak.