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### **Research says post-vehicle economic value can be reclaimed from li-ion batteries**

Mineta National Transit Research Consortium study shows how remanufacturing, recycling, repurposing can work

**San Jose, Calif., June 30, 2014** – Although electric and hybrid vehicles are gaining market share, one significant question remains. How can the used lithium-ion batteries be processed post-vehicle application? A new peer-reviewed Mineta National Transit Research Consortium report, [\*Remanufacturing, Repurposing, and Recycling of Post-Vehicle-Application Lithium-Ion Batteries\*](#), offers three possible alternatives. The study, conducted by Charles R. Standridge, PhD, and Lindsay Corneal, PhD, is ready for free download at <http://transweb.sjsu.edu/project/1137.html>

“Lithium-ion batteries provide efficient energy storage,” said Dr. Standridge. “Their use in vehicles will continue to expand, but we must deal with disposition once they fall below regulatory standards for use in on-road vehicles. To address that challenge, our studies have shown that many of these batteries may still hold a significant charge level and thus have additional economic value that can be reclaimed in one of three ways.”

- **Remanufacturing** for intended reuse in vehicles by replacing any damaged cells within the battery shows promise.
- **Repurposing** could be accomplished by reengineering a battery for a non-vehicle, stationary storage application.
- **Recycling** would involve disassembling each battery cell and safely extracting the precious metals, chemicals and other byproducts to be sold on the commodities market or re-introduced into a battery manufacturing process.

Results from forecasting models show that by 2035, the number of available post-vehicle-application batteries will range from 1.376 million (conservative) to 6.759 million (optimistic), which is sufficient to justify remanufacturing, repurposing, and recycling efforts.

A cost-benefit analysis was done independently for each of the three processes, with graphs provided in the report. Costs included operations, transportation, material handling, infrastructure development, and facility development. Benefits included avoided costs for battery storage and new battery production as well as sales of repurposed batteries and recovered materials in recycled batteries. Additional costs and benefits were shown for each individual process. Most significantly, recycling is economical only if supported by post-vehicle remanufacturing and repurposing applications.

Proprietary processes for remanufacturing, including comprehensive battery testing, have been developed by the team’s research partner Sybesma’s Electronics in Holland, Mich.

The report’s 16 figures include forecasting models, testing equipment, schematics, voltage readouts, and more. The seven tables include cost-benefit analyses, power requirements, and various test results. For a free PDF of the 58-page MTI research report, go to

<http://transweb.sjsu.edu/project/1137.html>

#### **ABOUT THE PROJECT INVESTIGATORS**

**Charles R. Standridge, PhD**, is associate dean of the Seymour and Esther Padnos College of Engineering and Computing at Grand Valley State University, where he is responsible for advising services, K-12 outreach activities, and the Department of Occupational Safety and Health. He also leads the technical work on the Lake Michigan Wind Assessment project whose goal is to examine the wind energy potential in the lake. He is active in curriculum development in energy systems. He received a BS in computer science from Washington University in St. Louis and an MS and PhD in industrial engineering/operations research from Purdue University.

**Lindsay Corneal, PhD**, is an assistant professor in the School of Engineering at Grand Valley State University. She has been active in developing curriculum concerning materials for energy systems. She earned a BAsC (Applied Science) in mechanical engineering with a materials option from the University of Windsor (Canada), an MBA from Lawrence Technological University, and a PhD in materials science and engineering from Michigan State University. She also was a product engineer at DaimlerChrysler (now Chrysler, LLC), where she was responsible for the power steering system for the Ram pick-up truck.

#### **ABOUT THE MINETA NATIONAL TRANSIT RESEARCH CONSORTIUM**

The Mineta National Transit Research Consortium (MNTRC) is composed of nine university transportation centers led by the Mineta Transportation Institute at San Jose State University. The Consortium was organized in January 2012 after winning a competition sponsored by the US Department of Transportation (DOT) to create consortia tasked with “Delivering Solutions that Improve Public Transportation.” Member universities include Bowling Green State University, Grand Valley State University, Howard University, Penn State University, Rutgers University, San Jose State University, University of Detroit Mercy, University of Nevada Las Vegas, and University of Toledo. Visit [transweb.sjsu.edu/mntrc](http://transweb.sjsu.edu/mntrc)

#### **ABOUT THE MINETA TRANSPORTATION INSTITUTE**

The Mineta Transportation Institute (MTI) conducts research, education, and information transfer programs regarding surface transportation policy and management issues, especially related to transit. Congress established MTI in 1991 as part of the Intermodal Surface Transportation Efficiency Act. MTI won national re-designation competitions in 2002, 2006 and 2012. The Institute is funded through the US Secretary of Transportation’s Research and Technology Office, US Department of Homeland Security’s Transportation Security Administration, the California Department of Transportation’s Division of Research, Innovation and Systems Development, and public and private grants. In 2006 the US Department of Homeland Security selected MTI as a National Transportation Security Center of Excellence. The internationally respected members of the MTI Board of Trustees represent all major surface transportation modes. MTI is the lead institute for the nine-university Mineta National Transit Research Consortium. MTI is affiliated with San Jose (CA) State University’s College of Business. Visit [transweb.sjsu.edu](http://transweb.sjsu.edu)

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