2013 DOE VEHICLES TECHNOLOGIES
PROGRAM REVIEW PRESENTATION
LITHIUM-ION BATTERY RECYCLING FACILITIES

PROJECT ID: ARRAVT020

Investigator: Mr. Todd R. Coy, Executive Vice President
Presenters: Mr. Hector A. Morales, MBA
Dr. Novis Smith, PhD
Organization: Toxco, Inc.

May 13, 2013

This Presentation does not contain any proprietary, confidential,
or otherwise restricted information
Toxco Inc., was the sole recipient of DOE funding under DE-FOA-0000026-
Area of Interest 4 (Advanced Lithium ion Battery Recycling Facilities)

Expanded facility to manage End of Life Hybrid and Electric Vehicle Batteries
currently under construction in Lancaster Ohio

Facility to utilize advanced recycling technologies to recover active battery
constituents for “Battery to Battery” recycling.

Construction project is contiguous to Toxco’s existing battery recycling facility
in Ohio.

Dedicated large format advanced battery recycling facility to provide long term
services and solutions to burgeoning HEV/EV industry.
## DOE Merit Review

<table>
<thead>
<tr>
<th>Overview</th>
<th>Electricore, Inc.</th>
<th>DOE Outreach, Industry Education, Reporting.</th>
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<tbody>
<tr>
<td><strong>Overall Project Completion</strong></td>
<td>More than 50%</td>
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**Unsuccessful Deployment of EV Technology**

**Market Conditions Apply**

**Flexibility in Recycling Technology**

### Overview

**Program Outlay as of 12/31/2012**

**Budget**

<table>
<thead>
<tr>
<th>Start Date</th>
<th>4/1/2010</th>
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<tr>
<td>Finish Date</td>
<td>12/31/2014</td>
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<table>
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<tr>
<th>Total DOE Project Funding</th>
<th>$9,552,551.00</th>
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<td>Total Contractor Cost Share Funding</td>
<td>$9,553,708.00</td>
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<tr>
<th>Program Outlay as of 12/31/2012</th>
<th>$6,735,134.07</th>
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<tr>
<td>Total DOE Funds Expended as of 12/31/2012</td>
<td>$3,367,567.03</td>
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<tr>
<td>Total Contractor Funds Expended as of 12/31/2012</td>
<td>$3,367,567.04</td>
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### RISKS

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<th>Consumer Confidence in New EV Technology</th>
<th>Market Conditions Apply</th>
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<tr>
<td>Unsuccessful Deployment of EV Technology</td>
<td>Market Conditions Apply</td>
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<tr>
<td>New Battery Technology Developments</td>
<td>Flexibility in Recycling Technology</td>
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### PARTNERS

### RESPONSIBILITY

**DOE Outreach, Industry Education, Reporting.**
Toxco Inc.’s objective is to construct a battery recycling facility dedicated to the recycling of large format high energy batteries used in hybrid and electric vehicles.

Toxco’s prime objective is to solve for various chemistries used in OEM vehicle and grid application platforms;

Recycle and Recover battery constituents for “Battery to Battery” recycling

Recover strategic metals such as Rare Earth Lanthanides from batteries to secure valuable resources.

Provide economic growth through the creation of new jobs in high tech recycling.
Objectives / Relevance

- Establish a sustainable business model in preparation for long term solution for EV/HEV batteries.
- Adaptable technological interface between multiple battery chemistries.
- Create industry partnerships to provide Battery Ready Materials to achieve low cost battery production for HEV/EV’s.
- Hire leading technologists to strive for continued improvements to meet the varied challenges in a rapidly changing environment.
- Creation of sustainable jobs in Ohio.
Approach

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As Toxco’s challenge in this space is unique among all ARRA recipients, due to the life cycle of HEV/EV batteries, Toxco has developed and fostered a collaborative approach with key industry players to build on business relationships and sustainable modeling with respect to End of Life Battery Recycling:

- Manage and recycle industrial battery waste from large OEM battery manufactures.
- Established recycling contracts and relationships with many OEM automotive manufacturers.
- Provide key recycling services to industry sponsored programs for end of life collection and recycling.
- Continue to enhance and improve recovery technologies in advance of completed construction.
- Continue industry outreach through presentations at various conferences and technical programs.
Approach

Environmental Standards
- Toxco is a fully permitted facility in Ohio.
  - OHIO EPA PERMIT - OHD071654958
- ARRA project is an expansion of an existing, successful, permitted battery recycling operation in Ohio.
- The New facility was chosen due to close proximity to ARRA funding recipients and U.S. automotive manufacturing hubs

NEPA Findings
- Toxco’s NEPA audit has been completed.
- A Finding of No Significant Impact was issued April 2010.

Go / NO Go Criteria
- Environmental Assessment - Completed
- Validation of Recycle process - Completed
- Facility Build (Construction) – 95% Completed (as of March 2013)
- Battery Recycling Processing Lines – 25% Completed (as of March 2013) with 60% of equipment at facility and awaiting installation
Approach
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- Define Customer Requirements
  - Determine Customer Timeline
  - Designate Appropriate Process Lines
- Identify Battery Chemistries per Application
  - Determine Market Size
  - Designate Capacities of Process
- Analytical/Battery Materials
- Identify Secondary Applications
  - Identify Partner
  - Define Partner Criteria

Facility design, layout, construction, and processing

- Battery Materials
- Secondary Batteries
Toxco has achieved recovery of rare earth metals in metallic form (third party validation) from recycled NiMh batteries.
- Validation of recovery technologies in pre-commercialized system.
- Relevance to Go/No Go Milestone – Success.

Facility Construction is near completion — First battery Lines to be implemented shortly.

Recovered battery materials have been submitted to 3rd party battery manufacturer for test cell production.

Continued enhancement of separation of cathode/sePARATOR/anode from LiB’s in advance of plant build out.
Since 2010 Toxco has created or sustained at least 10 FT jobs in relation to this project.

Toxco expects to add at least 15 new positions by end of 2013.

Currently engaged in discussions with multiple ARRA stakeholders on sustained recycling programs for batteries and materials.
Continued support and participation for industry led initiatives such as Recycling Task Force – Society Automotive Engineers

Continue to participate in industry collaboration via Vehicle Recycling Partnership - USCAR

Provide Education outreach on End of Life Battery Management through Trade Groups – Automotive Recyclers Association, and International Scrap Recycling Institute (ISRI)

Education through presentations and technical conference attendance.

- SAE – Vehicle Technology Symposium
- ISRI Annual Conference
- Automotive Battery Recycling Association
- PRBA
Toxco will continue with the construction of the Ohio expansion. Estimated construction completion – May 2013.

Equipment placement of the first battery recycling line expected complete June 2013.

Toxco will continue efforts in customer outreach and promotion of Toxco expanded service areas.

Development and continued validation of Battery Ready Materials to be used in the manufacturing of new battery products.

Begin interviews and hiring of initial staff for new operations May 2013 for the upcoming line.
Future work
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Toxco’s Construction Progress

http://www.toxco.com/
Future work
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Toxco’s Construction Progress