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RECYCLING HYBRID AND ELECTRIC VEHICLE BATTERIES

PROJECT ID: ARRAVT020

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Organization: Toxco Inc.

May 11, 2011

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or otherwise restricted information



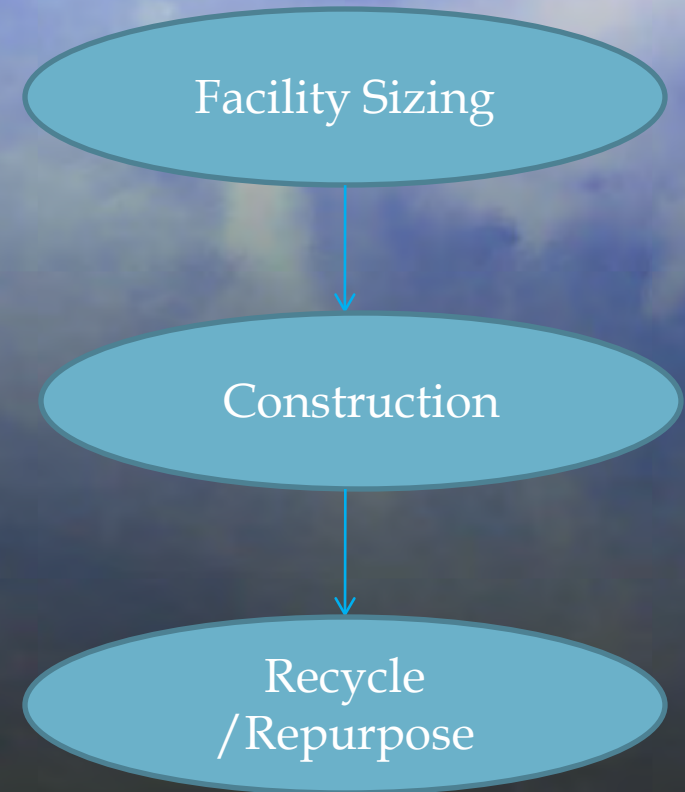
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- ❑ *Toxco Inc, is a global battery recycling company that specializes in the recycling of multiple battery chemistries. Toxco has specialized knowledge in the field of recycling high energy battery systems such as primary and secondary lithium batteries.*
- ❑ *Toxco has been recycling lithium batteries for over 18 years.*
- ❑ *Toxco was selected as a DOE funding recipient to construct a dedicated facility in Ohio to recycle large format high energy batteries used in hybrid and electric vehicles.*
- ❑ *Toxco is expanding existing battery recycling operations in Ohio with the DOE expansion facility being built adjacent to Toxco's existing operations.*
- ❑ *Toxco has developed enhance recycling and recovery technologies to recover battery components to return to the manufacturing sector.*

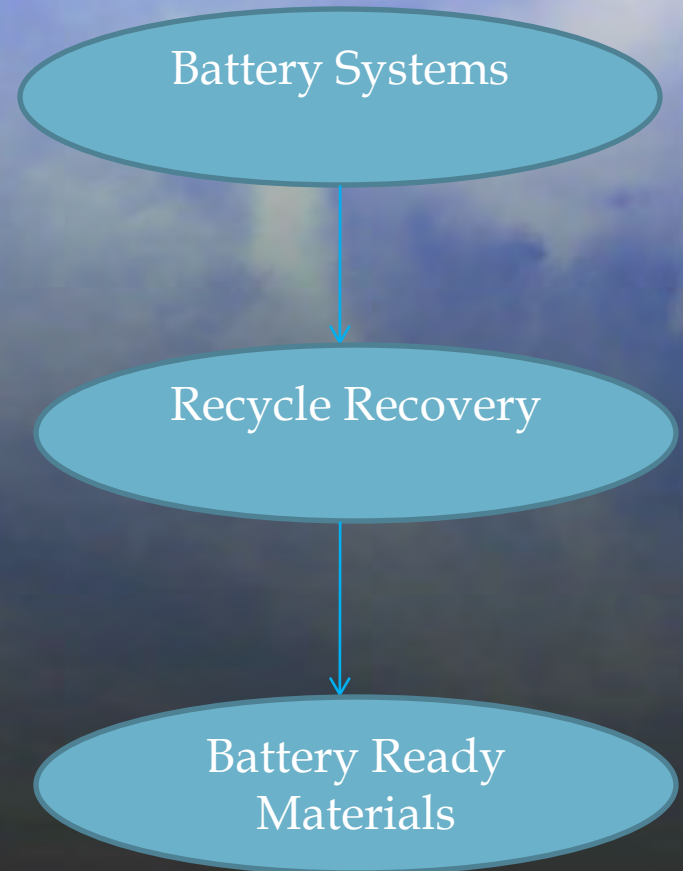


DOE Merit Review	OVERVIEW			
	Timeline		Barriers	Mitigation
Start Date	April 1, 2010		End of Life Vehicle Batteries Timeline	Sustainability in Processing Materials
Finish Date	December 2013		U.S. Battery Production Timeline	Managing Materials Through Pre-Production
	Budget		Cell Chemistry Identification	Working Groups within Industry (i.e., USABC)
DOE Project Funding	\$ 9,553,652		RISKS	
Contractor Project Funding	\$ 9,553,607		Consumer Confidence in New Technology	Market Conditions Apply
Funding Received 2009	0.00		Unsuccessful Deployment of Technology	Market Conditions Apply
Funding Received 2010	\$ 223,988.11		New Battery Technology Developments	Flexibility in Recycling Technology
Funding Received 2011 (to date)	\$ 72,123.95		Partners	
			Electri-Core	Collaboration / Resources

- ▣ *There are an approximate 1.9 million hybrid electric vehicles in North America Today.*
- ▣ *HEV/EV's sales are expected to reach 20% by 2020.*
- ▣ *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.*
- ▣ *Provide batteries for secondary life through repurposing and reconditioning*



- *Construct a fully integrated facility utilizing best developed technology.*
- *Install proven systems to recover battery materials that are reutilized for battery manufacturing.*
- *Create "New Resource" for battery materials and supply side logistics.*
- *Provide safe practices for management of large high energy battery systems.*
- *Ability to manage multiple battery chemistry systems within a developed technological infrastructure.*



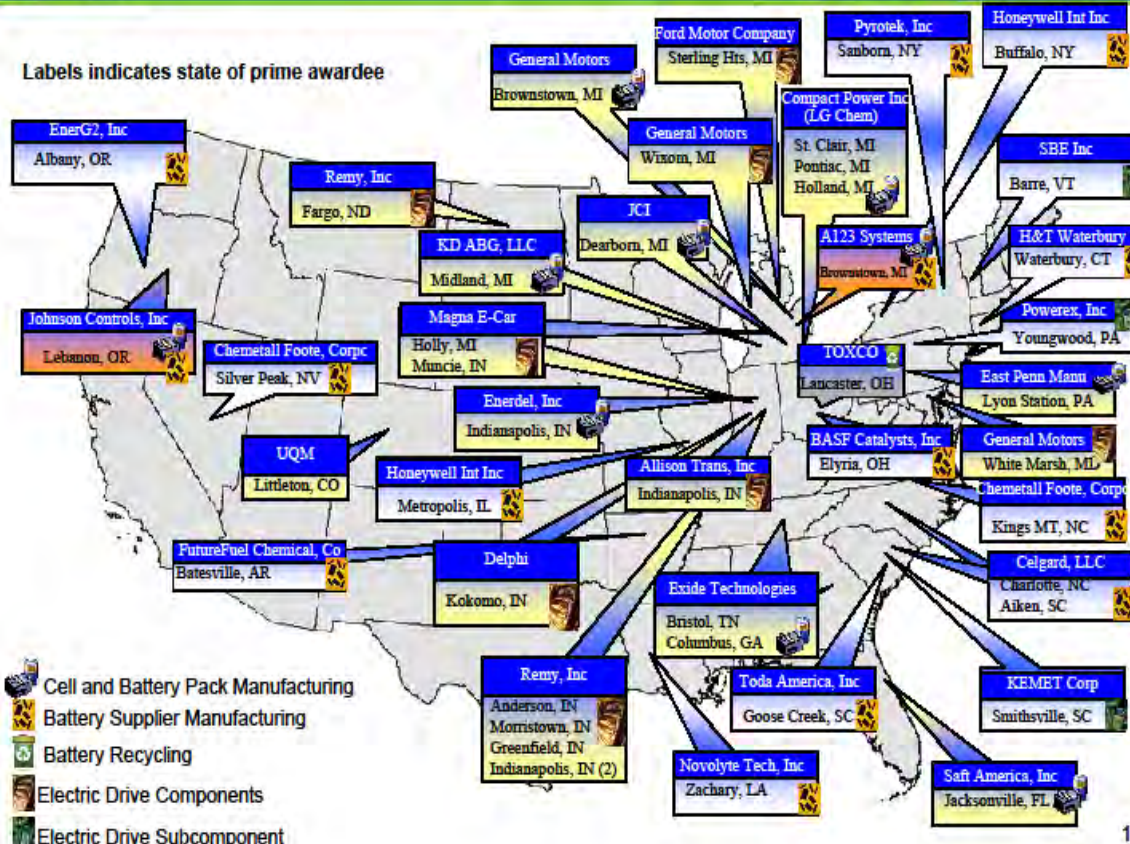
- *Toxco has taken a multidisciplinary approach in determining the Strengths, Weaknesses, Opportunities and Threats with respect to this program. Some of these areas are:*
 - *Enhanced technology development in battery recycling.*
 - *Recovery of materials as integral component of closed loop system.*
 - *In depth meetings and discussions with potential customers to define short, medium, and long term needs.*
 - *Continued research into market developments related to battery development.*
 - *Involvement with Trade Associations that have vested interest in national electrification infrastructure .*
 - *Participation in industry meetings and discussions related to end of life management of HEV/EV Batteries.*



Battery and Electric Drive Manufacturing Distribution

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

Labels indicates state of prime awardee



- Facility Siting in Lancaster Ohio.
- 60 % of Population within 650 miles.
- Close proximity to ARRA funding recipients
- Close to automotive manufacturing hub.



Facility design, layout, construction, and processing

Battery Materials

Secondary Batteries

To better understand the entire framework of required demands that a dedicated resource facility Toxco has reviewed:

- *Comprehensive life cycle approach to all facets of hybrid battery systems:*
 - *Recycling and recovery.*
 - *Transportation and handling.*
 - *Identification of components at manufacturer level.*
 - *Labeling of Cathode Materials*
- *Packaging and logistics across multiple industrial platforms.*
 - *Front end users of batteries.*
 - *End users of batteries.*



Technical Accomplishments and Progress

DOE Merit Review 2011

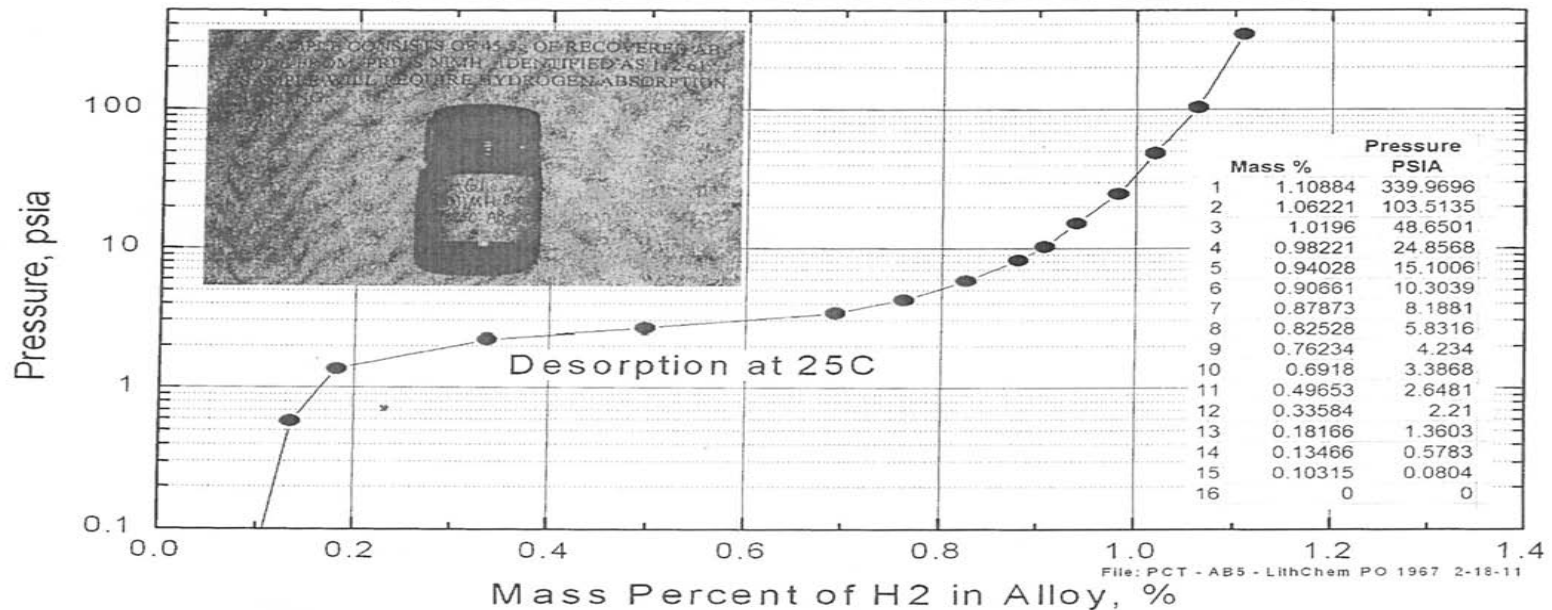
- ❑ *Toxco has achieved successful isolation and recovery of cathode materials from lithium ion batteries in recycling system.*
- ❑ *Successful isolation and recover of high purity Ab_5 Rare Earth misch metal alloy from EV nickel metal hydride batteries.*
- ❑ *Conducted successful recycling studies on multiple battery systems from automotive OEM'S, and battery manufacturers*
- ❑ *Successfully constructed lithium ion batteries utilizing recovered cathode materials from recycled batteries.*



Hydrogen potential in Toxco recovered Ab_5 Rare Earth anode (NiMH Battery)

Ergenics Corp.

Lithchem Energy - AB5 Type Hydride Alloy, Lot #112-61
 Lithchem Energy Purchase Order #1967
 Ergenics Reactor #02-11-11-A
 25C Desorption PCT, 93C bake-out to 82 microns



Technical Accomplishments and Progress

DOE Merit Review 2011

- *Recycling agreements in place with multiple Automotive OEM's.*
- *Environmental Assessment of facility location completed.*
- *Site survey work completed*
- *Civil and Storm Water Engineering completed*
- *Architectural plans and facility design work on schedule.*
- *Storm water permits approved.*
- *Retention pond work to begin April/May.*



Organization	Collaboration / Partners
	Function
Electricore	Liaison between Toxco and DOE, Project Management, Reporting, Outreach.
United States Advanced Battery Consortium	Consortium on Battery EOL Identification of material components, identification on battery management issues
Portable Rechargeable Battery Association	Trade Association on identifying underlying regulatory issues with EOL
Society Automotive Engineers	Battery Recycling Task Force identifying challenges in managing large format high energy batteries, establishing recycling standards for U.S. battery recyclers.
Automobile Recyclers Association	Addressing solutions on recovering and recycling large format batteries at end of life.

- ▣ *Complete Architectural and Design Work – April/May 2011*
- ▣ *Begin facility permitting – May 2011*
- ▣ *Process material flow diagrams completed – May 2011*
- ▣ *Begin facility construction - May/June 2011*
- ▣ *Begin initial equipment orders – June/July 2011*
- ▣ *Complete Facility Construction – Dec 2011*



- ▣ *Begin installation of 1st battery line – January 2012*
- ▣ *Begin installation of battery refurbishing /reconditioning processing - February 2012*
- ▣ *Complete installation of 1st battery recycling line – May 2012*
- ▣ *Ordering of equipment for 2nd battery processing line – May/June 2012*
- ▣ *Complete installation of battery refurbishing processing – May 2012*
- ▣ *Complete installation of 2nd battery recycling line Oct/Nov 2012*



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Future work

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Location of Toxco's planned expansion

