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2012 DOE VEHICLES TECHNOLOGIES PROGRAM REVIEW:

LITHIUM-ION BATTERY RECYCLING FACILITIES

PROJECT ID: ARRAVT020

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Presenter: Todd R. Coy

Organization: Toxco Inc.

May 16, 2012

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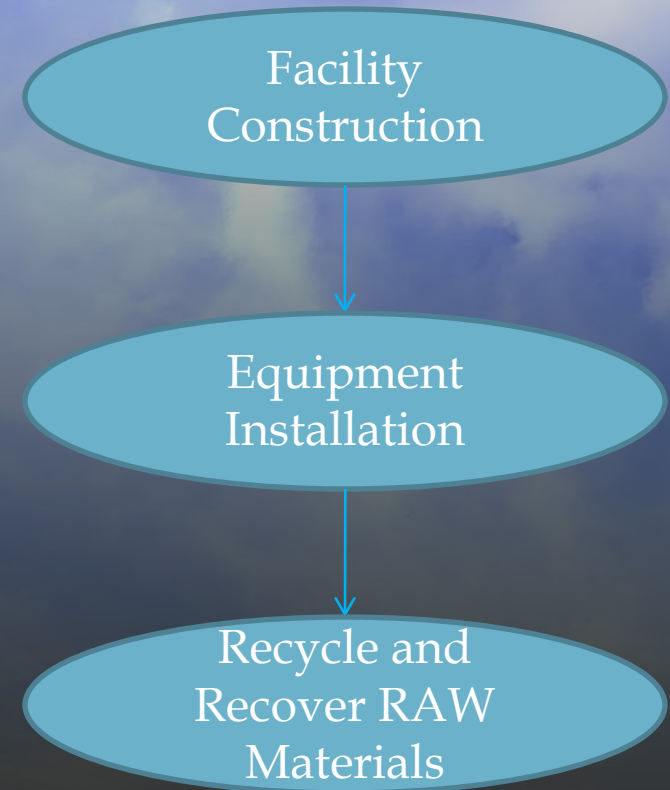


- ❑ *Toxco Inc, was the sole recipient of DOE funding under DE-FOA-0000026- **Area of Interest 4 (Advanced Lithium ion Battery Recycling Facilities)***
- ❑ *Expanded facility to manage End of Life Hybrid and Electric Vehicle Batteries currently under construction in Lancaster Ohio*
- ❑ *Facility to utilize 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.*

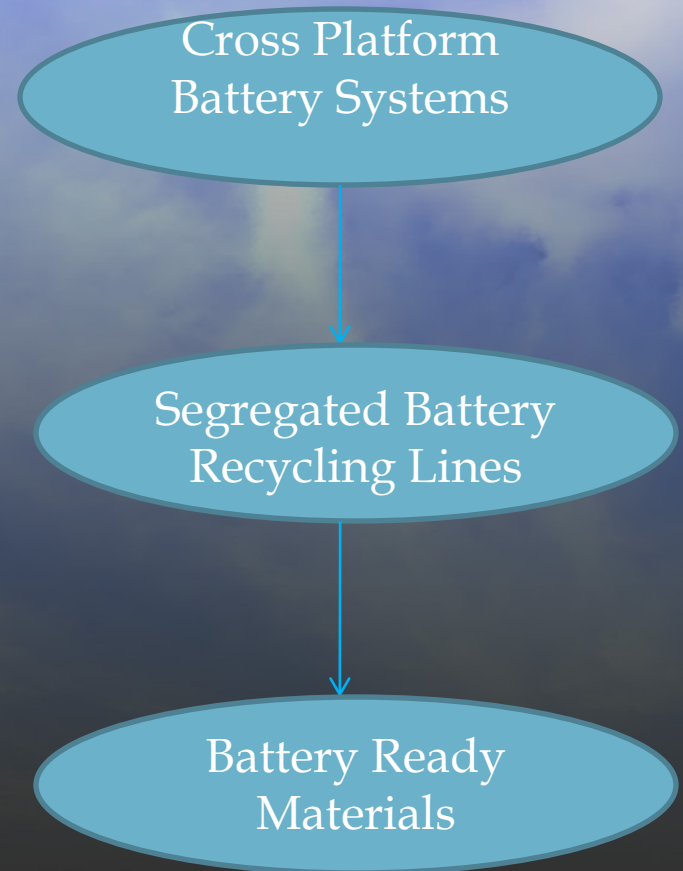
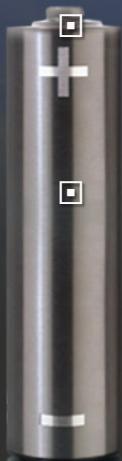


DOE Merit Review	OVERVIEW			
	Timeline		Barriers	Mitigation
Start Date	April 1, 2010		End of Life Vehicle Batteries Timeline	Sustainability in Processing Materials
Finish Date	December 2013		U.S. Battery Production Timeline	Managing Materials Through Pre-Production
Funding To Date	Budget		Cell Chemistry Identification	Working Groups within Industry (i.e. <u>USABC</u>)
DOE Project Funding	\$ 9,553,652		RISKS	
Contractor Project Funding	\$ 9,553,607		Consumer Confidence in New <u>EV</u> Technology	Market Conditions Apply
Capital Outlay 2011	\$ 3,056,021.05		Unsuccessful Deployment of <u>EV</u> Technology	Market Conditions Apply
DOE	\$ 1,634,837.09		New Battery Technology Developments	Flexibility in Recycling Technology
Contractor	\$ 1,634,837.09		Partners	Responsibility
Phase 1 Percentage Completed (Construction)	90%		<u>Electri-Core</u>	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.*



- *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.*



- *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.*



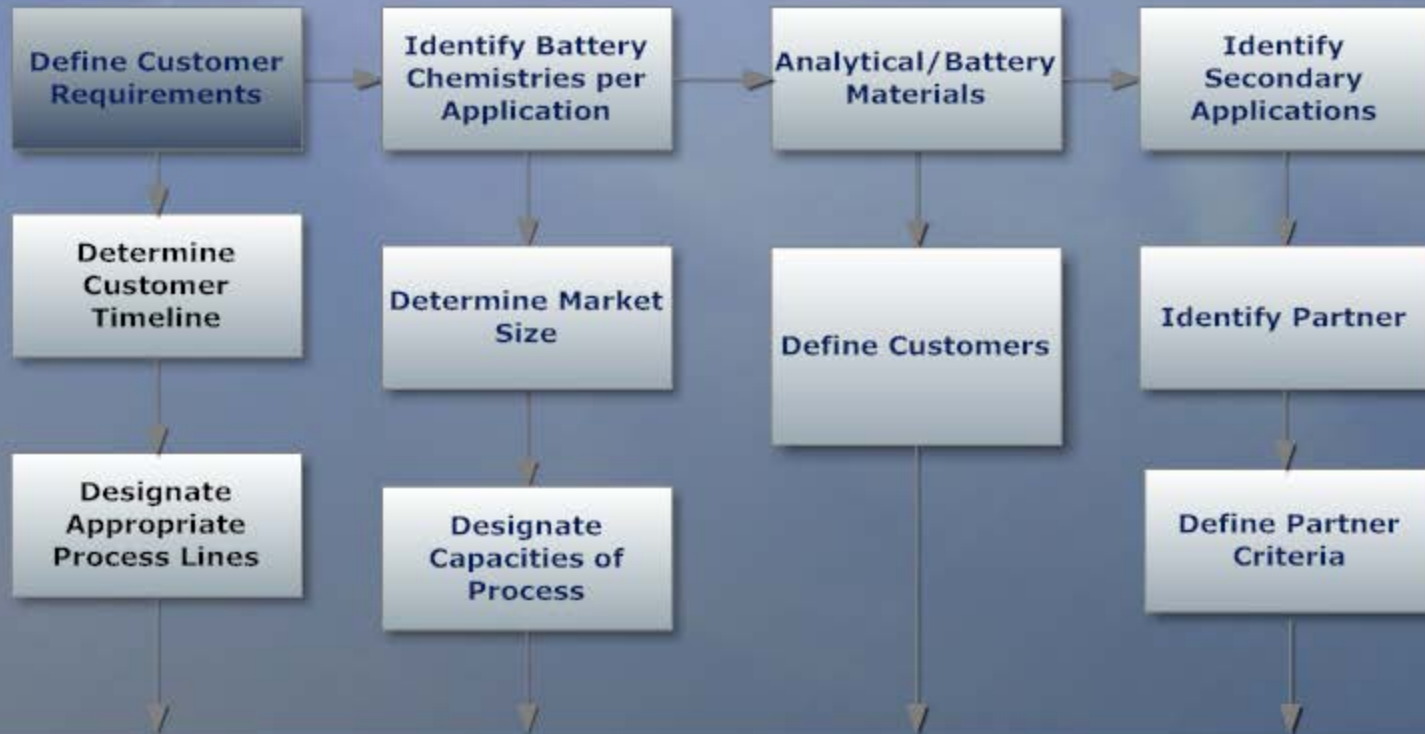
- *Environmental Standards*
 - *Toxco is a fully permitted facility in Ohio.*
 - *OHIO EPA PERMIT - OHD071654958*
 - *ARRA project is an expansion of an existing, successful, permitted battery recycling operation in Ohio.*
 - *The New facility was chosen due to close proximity to ARRA funding recipients 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) – 90% Completed*



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Facility design, layout, construction, and processing

Battery Materials

Secondary Batteries

Technical Accomplishments and Progress

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- *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 almost complete – April (historic rain events in Ohio has delayed progress) - First battery Lines implemented July – August.*
- *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.*



Technical Accomplishments and Progress

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- *Since 2010 Toxco has created or sustained 15 jobs in relation this project.*
- *Toxco expects to add at least 8 new positions by end of 2012.*
- *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 – April/May 2012.*
- ▣ *Equipment placement of the first battery recycling line expected complete July – August 2012*
- ▣ *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 June - July*



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Future work

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Toxco's Construction Progress

