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Toda America Inc.

Project ID: ARRAVT017
Esarravt017_han_2010_p_final

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### Overview

#### Li-ion Cathode Materials Production Facility

<table>
<thead>
<tr>
<th>Timelines</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>- Start: February, 2010</td>
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<tr>
<td>- Finish: December, 2013</td>
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<tr>
<td>- 1st Line Schedule: Feb., 2011</td>
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<tr>
<td>- Completion: ~10%</td>
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<tr>
<td>- Compressed schedule – first line production within 1 year of project start</td>
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<tr>
<td>- Timely product/process validation with customers</td>
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<tr>
<th>Budget</th>
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<tbody>
<tr>
<td>- $70MM total</td>
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<td>- 50% Cost-shared</td>
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<tr>
<th>Partners</th>
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<tbody>
<tr>
<td>- ITOCHU Corporation</td>
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<tr>
<td>- Argonne National Labs (Li-ion cathode materials license)</td>
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</table>
Toda Cathode Materials Facility
President Obama’s Vision:
- One million plug-in hybrid electric vehicles on the road by 2015

ARRA DOE Grant provides $2.4 billion to:
- Accelerate the development and production of EDV systems
- Develop production-ready batteries, power electronics, and electric machines that can be cost-effectively produced
EDV Demand Projections

Source: Institute of Information Technology LIB Related Study Program 08-09
Lithium-Ion EDV Batteries

• High energy rechargeable batteries allow vehicles to be powered by electricity

• Lithium-ion batteries are long lasting, safe and are being implemented in current and future EDVs

• Cathode materials are key chemical components of batteries in Li-ion Batteries

➢ Toda is a proven leading producer of Li-ion cathode materials and a strategic supplier for battery customers worldwide
Toda Background

- World’s leading manufacturer of Solid State Chemistry Particles with 186 year history
- Broad product breadth of all key cathode materials
- Quality leader with long experience and knowledge of products, processes and application
- Cost leader with large scale production of Li-ion materials and integrated supply chain
- Precursor development and production experience
- Li-ion cathode materials supplied globally to key players in the battery industry
- Will produce DOE Argonne National Laboratory’s next-generation cathode material technology
ITOCHU Background

• 50/50 JV partner with Toda in venture
• $120 billion transaction global diversified trading company
• Focused growth strategy ("L-I-N-E-s")
• Core competencies in business management and partnerships, finance, trading and sales
• Complementary to Toda’s strengths in Battery materials R&D and manufacturing
Application of TODA Products

NiM₁M₂(OH)₂ Precursor
LiCoO₂, LiNiCoAlO₂

NiM₁M₂(OH)₂ Precursor
LiCoO₂, LiNiCoAlO₂, LiNiCoMnO₂, LiMn₂O₄

Windpower

HEV, PHEV, BEV

Smart Grid

Mobile

NiMeH Consumer

Power Tool
TODA’s Cathode Materials for Lithium-Ion battery packs

Plug-In Electric Vehicle
Source: National Renewable Energy Laboratory

TODA Cathode Materials

Battery
Toda Battery Material Facilities - Project Support Structure

Onoda, Japan

Sarnia, Canada

Kitakyushu, Japan – Sister Plant
Integrated Product Development Process

Dry Synthesis
Creation of functional particles
ex.) LiCoO$_2$, Li(NiCoAl)O$_2$, Li(NiMnCo)O$_2$, LiMn$_2$O$_4$

Wet Synthesis
Creation of precursor particles from ionic solution
ex.) Co$_3$O$_4$, NiMnCo(OH)$_x$, NiCoAl(OH)$_x$, Mn$_3$O$_4$

Products
Solution for customers and applications

Design of Particles
- Type
- Shape
- Size
- Distribution
- Surface
Commercial Products for Cathode Materials

- LCO
- LiMn$_2$O$_4$
- Me(OH)$_x$
- LMO
- LNCA
- LNCM
R&D on All Cathode Materials

- LCO, LNCA, Li-rich NCM and LMO currently available commercially by Toda
- LMNC (Li$_2$MO$_3$-LMO$_2$ composite material), LNM(Sp) and Olivine compounds are under development for future market introduction

<table>
<thead>
<tr>
<th>Cathode Material</th>
<th>Capacity (Ah/kg)</th>
<th>Working voltage (V)</th>
<th>Energy Density (Wh/kg)</th>
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<tbody>
<tr>
<td>LMNC</td>
<td>270</td>
<td>3.5</td>
<td>945</td>
</tr>
<tr>
<td>LNCM</td>
<td>160</td>
<td>3.7</td>
<td>592</td>
</tr>
<tr>
<td>LNCA</td>
<td>200</td>
<td>3.7</td>
<td>740</td>
</tr>
<tr>
<td>LCO</td>
<td>160</td>
<td>3.8</td>
<td>608</td>
</tr>
<tr>
<td>LMO</td>
<td>100</td>
<td>3.8</td>
<td>380</td>
</tr>
<tr>
<td>LNM</td>
<td>145</td>
<td>4.75</td>
<td>690</td>
</tr>
<tr>
<td>LFPO</td>
<td>150</td>
<td>3.4</td>
<td>510</td>
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- C-rate: 0.05, 0.1, 0.1, 0.07, 0.1

- Solvent: 30EC+70DEC, 33EC+67DMC

- Electrolyte: LiPF$_6$
Toda U.S. Production Project Highlights

• $70+ Million Total Investment
• 18 acre brownfield site in Fort Custer Industrial Park
• 4000 tons/yr planned production of Lithium-ion cathode materials (LiNiCoAlO$_2$ and LiNiCoMnO$_2$)
  – 450,000 hybrid electric vehicles (HEVs)
  – 125,000 plug-in hybrid electric vehicles (PHEVs)
• First production February 2011 and Full capacity production December 2013
• 57 direct employees at completion
  – Estimated 148 total new jobs created per MEDC
• $130 million annual sales of product at capacity
Toda Battle Creek Site
### Project Milestones

**Fast-track project on schedule!**

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<thead>
<tr>
<th>Milestone</th>
<th>Status / Target Dates</th>
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<tr>
<td>DOE Award Announcement</td>
<td>August 2009</td>
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<tr>
<td>DOE Award Agreement Signing</td>
<td>February 2010</td>
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<tr>
<td>Site Preparation Completed</td>
<td>March 2010</td>
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<tr>
<td>Phase 1 Construction Start</td>
<td>April 2010</td>
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<tr>
<td>Phase 1 – Step 1 Completion</td>
<td>December 2010</td>
</tr>
<tr>
<td>Production Validation Step 1</td>
<td><strong>February 2011</strong></td>
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<tr>
<td>Phase 1 – Step 2 Completion</td>
<td>September 2011</td>
</tr>
<tr>
<td>Decision for Phase 2 Start</td>
<td>October 2011</td>
</tr>
<tr>
<td>Phase 2 Construction Start</td>
<td>June 2012</td>
</tr>
<tr>
<td>Phase 2 Completion</td>
<td>July 2013</td>
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*Completed*
Site Remediation Completed and Construction Started
Toda Cathode Materials Facility
1. World leading solid state chemistry company with proven experience in scale manufacturing of Li-ion cathode materials
2. Production of DOE ANL’s 2nd generation Li-ion technology
3. Building $70+ million ($35 million DOE cost share) Li-ion Cathode Materials plant with 4000 ton/yr product capacity
4. Battle Creek, MI, 18 acre brownfield redevelopment site
5. Step-wise capacity plan: Phase 1 Step-1 completion February 2011, Step-2 completion December 2011; and Phase 2 full completion December 2013 depending on demand
6. Phase 0 pre-construction preparations completed:
   • Site remediation completed
   • MDNRE liability protection approval obtained
   • DOE NEPA EA “FONSI” certified
7. Phase 1 construction started on April 1, 2010 on schedule
8. Official Groundbreaking ceremony held on April 20, 2010