



The State of Battery R&D and Manufacturing in the U.S.

- The Battery Industry Perspective

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Compact Power

an LG Chem subsidiary

CPI Mission

- Established in Colorado in 2000, to focus on vehicular batteries. Moved to Troy, Michigan, in 2005 with only 3 employees.
- Provide Turn-key solutions for HEV/PHEV/EV applications.
- Current Employees: > 150.
 - Most of them had no prior experience working in battery or energy-related fields.
- USABC/DOE support was extremely critical in the lean years of 2003-2006!

CPI Focus: Pack R&D / Production / Support

Ø Battery Pack Concepts and Designs

Ø Power & Signal Architectures, Packaging, Thermal Management

Ø Battery Management Systems

Ø Charge control algorithms (State-of-Charge estimation), Diagnostics (State-of-Health estimation)

Ø Battery Pack Production and Support

Ø Prototypes, Production, Pack-level Analysis, Validation, and Verification, System Integration & Test Support

A lot of collaborative research with many companies as well as universities!

LG Group

Global presence in over 120 countries with **\$113b in revenue** and **160,000 employees**.

*“Creating a Solid, Competitive,
Strong and Dynamic LG”*



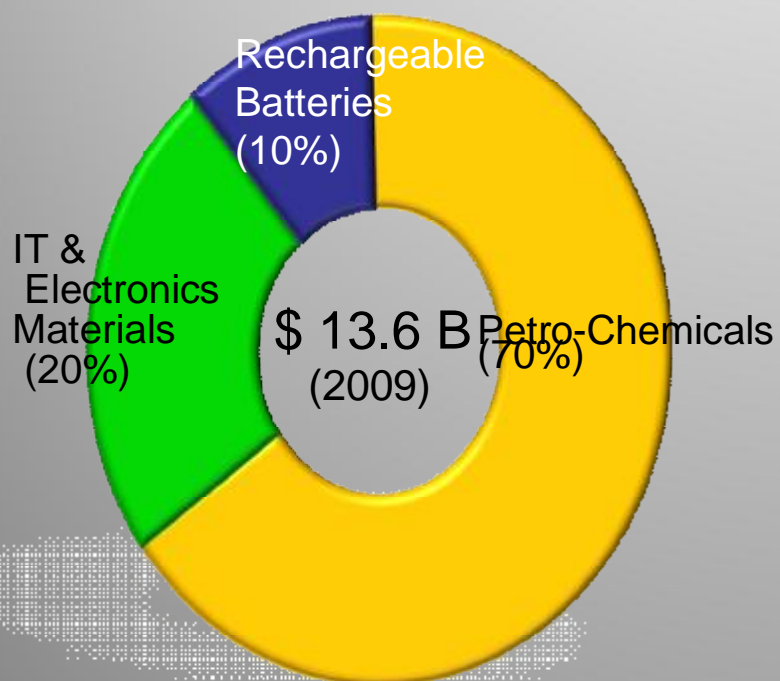
- ü Holding Company
- ü Chemicals
- ü Electronics / Display
- ü Telecommunications

LG Chem

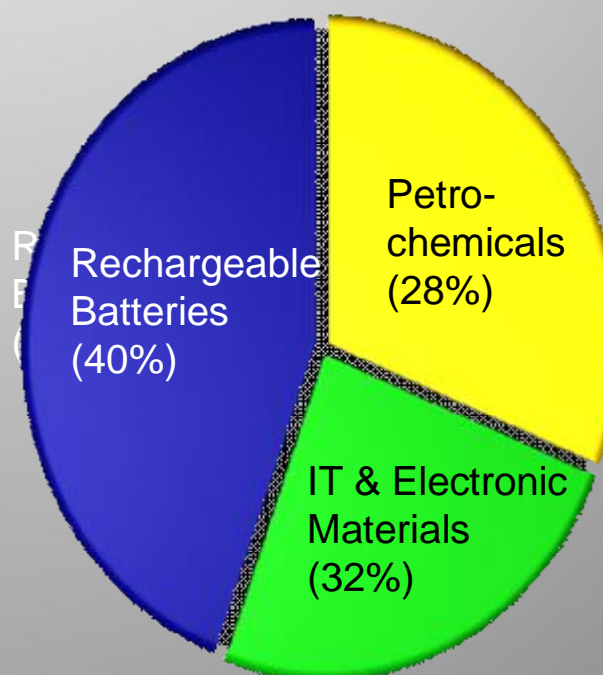
History

- 1947 Lucky Chemical Industrial Corp. founded
- 1995 Lucky Chemical changed its name to LG Chemical

Revenue



R&D Expense Portfolio



\$1B
R&D
budget
over
the
next
5
years

Revenue & Workforce in 2009 – 13.6 Billion US\$ / 13,000 employees

Product Line-up

Small Size Li-ion Batteries



Cylindrical



Prismatic

Mid-Large Size



Polymer (Laminated)

Key Customers



Our R&D and Manufacturing Story



EXPERIENCE

- The only chemistry-based company among battery makers
- Experience in mass production for more than 10 years



TECHNOLOGY

- Intensive in-house and collaborative work on material research
- *Stack & folding structure, Safety reinforced separator, next gen cathode*
- Validation of technology by major customers



SYNERGY

- Vertically integrated operation
 - : In-house production of key battery components
- Synergy among affiliates
 - : LG Electronics & LG Innotek (for BMS), LG Telecom, LG CNS etc.

Cell Manufacturing Facility: Holland

- DOE share: :\$151 M; 50/50 cost-share
- Start: Sep 01st, 2009
- Ground-Breaking: July 15, 2010 by President Obama
- Cell Production: 2012
- Electrode production: 2013
- Total Cell production: 15~ 20M
- Employees: 300+

Battery Bubble? A note of caution!

- We have recently been building/investing in battery plants. But how long will this support/focus last?
- There is an increasing concern for overcapacity. 2xCapacity in 2015.
- OEMs bringing pack manufacturing in-house. Others have joint ventures.
- Those who threw in the towel /perished / merged.
 - Duracell
 - Energizer
 - Polystor
 - Motorola ESG
 - HET, RBI, LTC
 - Moltech
 - MoliCell
 - Electroenergy
 - Imara
 - Firefly

R&D Support: Going Forward!

- As in the past, Govt needs to support basic research in the future.
- Provide jolts such as the Stimulus Fund to manufacturing sector!
- But for long-term sustainability, the support needs to come from the private sector
 - From the Management: OEMs, battery-, material- and equipment producers
 - From long-term visions for the society, company
 - We should not be led, even though it is very easy and tempting, by concerns for short-term, quarterly profits.
- Battery R&D is like a marathon race. Only US industry that has traditionally been known to have such a reputation is the pharmaceutical industry!