Shocking Future Battering the Lithium Industry through 2020

Edward R Anderson
B.Sc.(Hons)., Dpl.(Marketing Research)., MBA., FCIArb

TRU Group Inc
trugroup.com
✉️ anderson@trugroup.com

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History of this update 2011

✓ Update presented at IM January 2009 Santiago
✓ Periodically tracked and updated by TRU
✓ Major update and restructuring last month 2010
Outlook Objective

To develop a base case demand-supply forecast for the global lithium market through 2020

- lithium consumption by main end-use
- lithium sources of supply – brine & mineral
- main determinants of demand and supply
- establish demand-supply balance and impacts

- main purpose is supply-demand balance through 2020.
TRU Approach

- **Strong Qualified Team**
  - Brine, Mineral Mining, Extraction and Processing
  - Basic & Intermediate lithium Chemicals Engineering Processing
  - Lithium End-using Industry Experts
  - Modeling, Technology Forecasting, Market Research, Cost Analysts

- **Clear Proven Track Record**
  - Several multi-billion-dollar, High Tech Li-Chemical and Lithium Juniors as Clients
  - Numerous Engineering, Feasibility Studies and Due Diligence Completed

  Professional • Independent • Bankable

  **2009 Santiago Forecast Correct**

  - Sustainability on Supply Side
  - Sustainability on the Demand Side

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Model Update 2011

Demand Side
• Recession 2009-10 deeper and more global
• Recession recovery only in 2011

Supply Side
• New lithium projects proceeding **whatever**?
• Probability of project cancelations, delay and *(technical + business)* failures!
Demand Curve

Total Global Lithium Demand - History and 2010-2020
Li-contained t

- Lithium Contained t

All Lithium Demand
lithium contained t

Year

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Batteries Impact on Total Global Lithium Demand History and 2010-2010

Total Lithium Demand

% Batteries of Total

Lithium in All Batteries

Lithium Demand t Li-contained

Year


0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000 16,000 17,000 18,000 19,000 20,000 21,000 22,000 23,000 24,000 25,000 26,000 27,000 28,000 29,000 30,000 31,000 32,000 33,000 34,000 35,000 36,000 37,000 38,000 39,000 40,000 41,000

Lithium in All Batteries

Total Lithium Demand

% Batteries

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User Segment Patterns

Lithium Consumption by End-Use History and 2010-2020

- Batteries
- Air Conditioning
- Al Process Add
- Ceramics Glazing
- Glass Direct
- Lubricants
- Pharmaceuticals
- Polymer Process
- Synthetic rubber
- Alloy & Other
- Other

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## Battery Use of Lithium by Type

<table>
<thead>
<tr>
<th>Battery Type</th>
<th>2005 % total</th>
<th>2010 % total</th>
<th>2020 % total</th>
<th>% Growth pa 05-10</th>
<th>10-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Batteries</td>
<td>26%</td>
<td>19%</td>
<td>8%</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>Secondary Batteries</td>
<td>74%</td>
<td>79%</td>
<td>49%</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>EV Batteries</td>
<td>0%</td>
<td>2%</td>
<td>43%</td>
<td>316%</td>
<td>64%</td>
</tr>
<tr>
<td><strong>ALL BATTERIES</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>14%</strong></td>
<td><strong>14%</strong></td>
</tr>
</tbody>
</table>
Electric Vehicle Production Outlook by Type

2010-2020 Most Likely Scenario

World Electric Vehicle Production

Year

Number of Vehicles

Electric Vehicle Production Outlook by Type

2010-2020 Most Likely Scenario

World Electric Vehicle Production

World Electric Vehicle Production

All HEV

HEV

PEV

Series 5

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## Electric Vehicle Li-Battery Development Fundamentals

<table>
<thead>
<tr>
<th>Electric Vehicle Type</th>
<th>Year Technical Issues Resolved for Lithium Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid Electric Vehicle</td>
<td>2011</td>
</tr>
<tr>
<td>Plug-in Hybrid Electric Vehicle</td>
<td>2014</td>
</tr>
<tr>
<td>Plug-in Electric Vehicle</td>
<td>2015</td>
</tr>
<tr>
<td>Fuel Cell Vehicles</td>
<td>2018</td>
</tr>
</tbody>
</table>
### User Segment Overview

<table>
<thead>
<tr>
<th>USE SEGMENT</th>
<th>2005</th>
<th>2010</th>
<th>2020</th>
<th>% Growth pa 05 - 10</th>
<th>10 - 20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% total</td>
<td>% total</td>
<td>% total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>8%</td>
<td>7%</td>
<td>4%</td>
<td>-0.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Aluminium Process Add</td>
<td>4%</td>
<td>3%</td>
<td>1%</td>
<td>-4.5%</td>
<td>-1.2%</td>
</tr>
<tr>
<td>Batteries</td>
<td>10%</td>
<td>18%</td>
<td>47%</td>
<td>13.8%</td>
<td>18.7%</td>
</tr>
<tr>
<td>Ceramics Glazing</td>
<td>12%</td>
<td>10%</td>
<td>6%</td>
<td>-3.5%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Glass/Ceramic Li Add</td>
<td>23%</td>
<td>26%</td>
<td>17%</td>
<td>3.0%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Lubricants</td>
<td>8%</td>
<td>9%</td>
<td>6%</td>
<td>2.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>5%</td>
<td>5%</td>
<td>3%</td>
<td>2.9%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Polymer Process</td>
<td>4%</td>
<td>4%</td>
<td>2%</td>
<td>0.7%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Synthetic rubber</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
<td>-0.2%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Other Plus Alloy</td>
<td>22%</td>
<td>15%</td>
<td>11%</td>
<td>-6.9%</td>
<td>5.1%</td>
</tr>
<tr>
<td><strong>ALL USES Li-contained</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>1.0%</td>
<td>8.0%</td>
</tr>
<tr>
<td><strong>Chemical Uses Demand</strong></td>
<td>77%</td>
<td>74%</td>
<td>83%</td>
<td>0.3%</td>
<td>9.3%</td>
</tr>
<tr>
<td><strong>Glass/Ceramics Direct</strong></td>
<td>23%</td>
<td>26%</td>
<td>17%</td>
<td>3.0%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
Supply Classes

Level I: Supply from Existing Plants

Level II: Pipeline Projects Supply 2010-2015

Level III: New Developments Supply 2015-2020
Notable Supply Drivers

i. Existing low-cost (brine-based) plants can expand significantly

ii. Emerging technologies provide new options for medium-scale lithium developments *

iii. Mineral-based supply (for basic Li chemicals) could be a back-up for supply with price escalation

* selective ion adsorption, electrodialysis, nanofiltration, etc
Supply All Li Grades by Stage

<table>
<thead>
<tr>
<th>Supply Stage</th>
<th>2010 % total</th>
<th>2015 % total</th>
<th>2020 % total</th>
<th>Average % Grow 10-15</th>
<th>15-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Plants</td>
<td>79</td>
<td>67</td>
<td>60</td>
<td>7.7%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Pipeline Plants</td>
<td>0</td>
<td>16</td>
<td>15</td>
<td>122.3%</td>
<td>7.3%</td>
</tr>
<tr>
<td>New Developments</td>
<td>0</td>
<td>3</td>
<td>14</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Glass Use Direct</td>
<td>20</td>
<td>14</td>
<td>11</td>
<td>4.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td><strong>Total Lithium Supply</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>11.4%</td>
<td>8.4%</td>
</tr>
</tbody>
</table>
Lithium Supply by Project Stage 2010 - 2020 t Li-contained

- Supply from All Sources Mineral and Brine
- Existing Plant
- New Developments
- Pipeline Projects
- Minerals Glass Direct

Year

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All Lithium Supply-Demand

Underlying Total Lithium Industry Balance
2010-2020

Lithium Contained t

Year


All Lithium Supply

All Lithium Demand

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Chemical Grade Lithium
Supply Band vs. Demand

ALL Pipeline Projects Plus Existing Plant Supply
versus Chemical Grade Demand 2010-2020
$t Li-contained

Chemical Grade Demand
Existing Total Supply
Brine-based supply

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Chemical Grades
Lithium Market Balance

Market Balance
Total Supply versus Chemical Grade Demand
2010-2020
\( t \text{ Li contained} \)

Annual Balance
\(- t \text{ Li-contained} \)

Total Supply
Existing + Pipeline + New Developments

Existing Total Supply

Chemical Grade Demand

Demand-Supply \( t \text{ Li contained} \)

Balance \( t \text{ Li-cont} \)

Year

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How & Why Shocking?

- Massive lithium oversupply through 2020
- Very few projects survive of sixty plus
- Exploitation and misuse of 43-101 reporting
- “Qualified Persons” who are far from it!
- Lithium chemical engineers who are not
- Investors will predictably lose millions
- Stock market regulators asleep
Lithium Price Outlook 2020

Model Suggests: “Stable Prices Scenario”

Forecast Lithium Carbonate Price
Constant US$ per t

$ per t Li-Carb

2008 2009 2010 2011

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Summary Outlook 2020

Global Recession has pushed industry into over-supply through 2009-2013

Pipeline Projects increase supply-demand gap 2013-2015

New Development Projects exacerbate oversupply situation 2015-2020

2017-2018

Serious Peak Oversupply

Even Existing Producers Negatively affected
Thank You!

Edward R Anderson
B.Sc.(Hons)., Dpl.(Marketing Research)., MBA., FCIArb
President & CEO

TRU Group Inc
trugroup.com
anderson@trugroup.com

Tucson 1-520-575-0674
Toronto 1-416-935-1754
Cell 1-520-229-7836

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