



# Sustainable Lithium Supplies through 2020 in the face of Sustainable Market Growth

**Edward R Anderson**

B.Sc.(Hons)., Dpl.(Marketing Research)., MBA., FCI Arb

**TRU Group Inc**

[trugroup.com](http://trugroup.com)

✉ [anderson@trugroup.com](mailto:anderson@trugroup.com)

[Link to slide show version of this presentation with notes](#)

# Original Work mid-2008



## Mitsubishi Corporation

Strong interest in Lithium -

- ✓ **Materials**
- ✓ **Batteries**
- ✓ **Electric Vehicles**



# 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
- main determinants of demand and supply
- demand-supply balance scenarios

**- main purpose was supply-demand balance through 2020.**

# Our Approach

## ☐ Strong Qualified Team

- Brine, Mineral Mining, Extraction and Processing
  - Basic & Intermediate Chemical Processing
  - Lithium End-using Industry Experts
- Modeling, Technology Forecasting, Market Research, Cost Analysts

[View TRU Lithium Team expertise](#)

## ☐ Sustainability on Supply Side

## ☐ Sustainability on the Demand Side

# Mapped Industry Structure



**Lithium Carbonate**



**Lithium Hydroxide**

**Low Na Lithium Chloride**

**High Na Lithium Chloride**



- Batteries
  - Air Conditioning
  - Polymers
  - Glazing Ceramics
  - Aluminum Process
  - Other Li Carbonates
- Li Phosphate
  - Li Nitrate
  - Li Carbonate
- Lubricants
- Primary Batteries
  - Aluminum Alloys
- Polymers
  - Pharmaceuticals
  - Chemicals
- Other High Na Li Chlorides >
- Glass
  - Ceramics

# Model Update 2009

## □ Demand Side

- Recession much more serious and more global
  - Credit crunch crisis impact - for how long?

## □ Supply Side

- Announced lithium projects delayed?
- Some new information available on producers

# Situation Update 2010

Inserted November 18, 2009

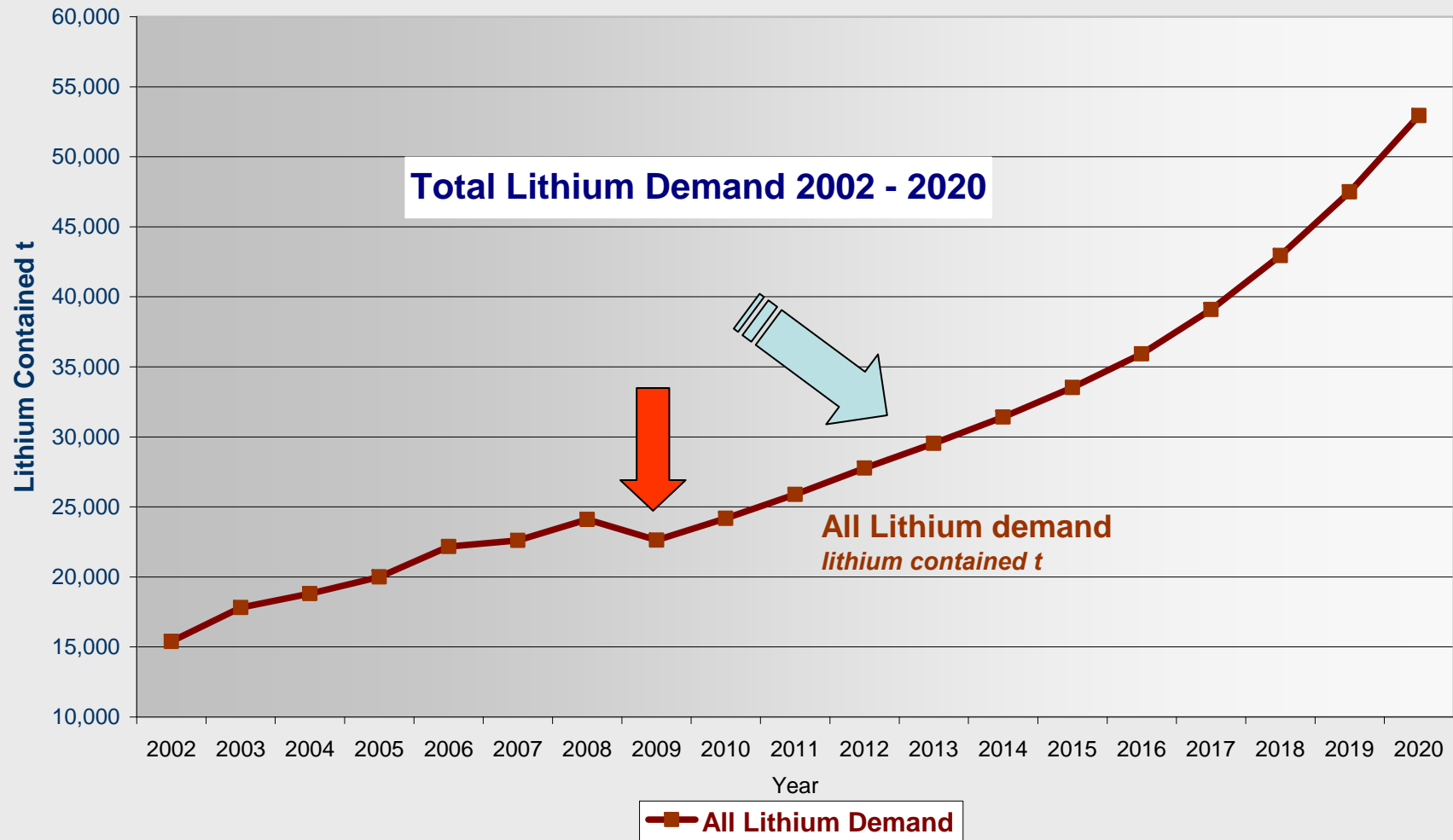
- ❑ Earlier projection for 2009 demand decline for full year now expected to exceed minus 12%
- ❑ Important distinctive TRU forecast for lithium use in electric vehicles (especially plug-in) and lithium metal alloy proving correct!
  - ❑ No Changes to Long Range 2020 Projection Required
- ❑ Supply side flood of new projects announced supporting TRU forecasts on the production side
- ❑ Balanced orderly development through 2020 affirmed

[Click for link to TRU Press November 18 Press Statement](#)

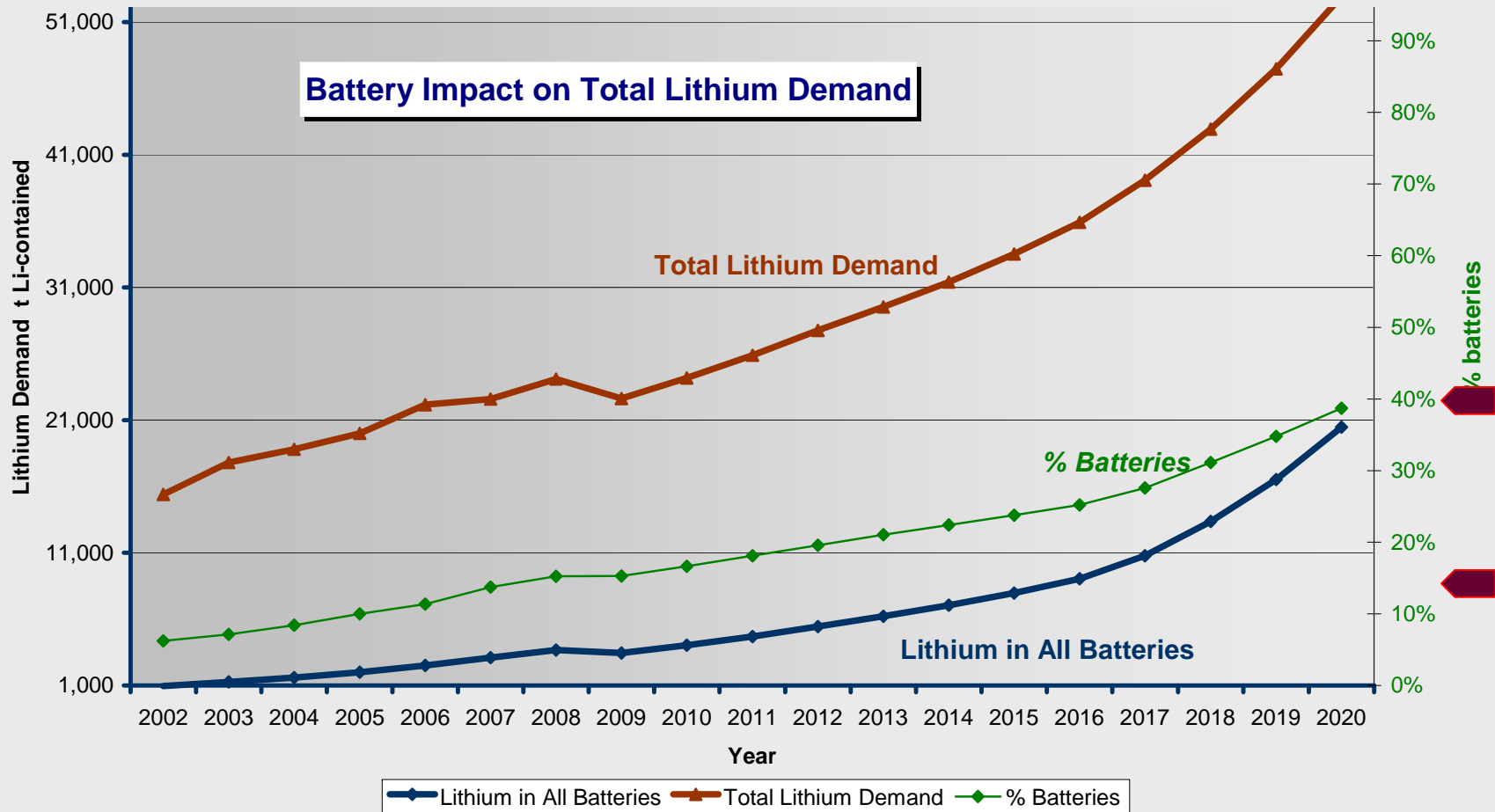
TRU assists companies from exploration, process engineering and lithium product design. In 2009 TRU technical assessed and ranked all 170 lithium salt lake salars and also the thirty pipeline mineral-based projects being promoted. TRU president Edward R Anderson says “The barrier to development for most projects is inadequate use of well qualified (certified bankable) lithium engineering expertise. Lithium process engineering is highly specialized and many of these start-ups have no experience in chemical plant project development. Missteps and engineering failures are inevitable. Other new projects will prove unprofitable because their promoters underplay the competitiveness of the industry. Success of a lithium resource development requires solid state-of-the-art technology and the industry strategic smarts to compete”.



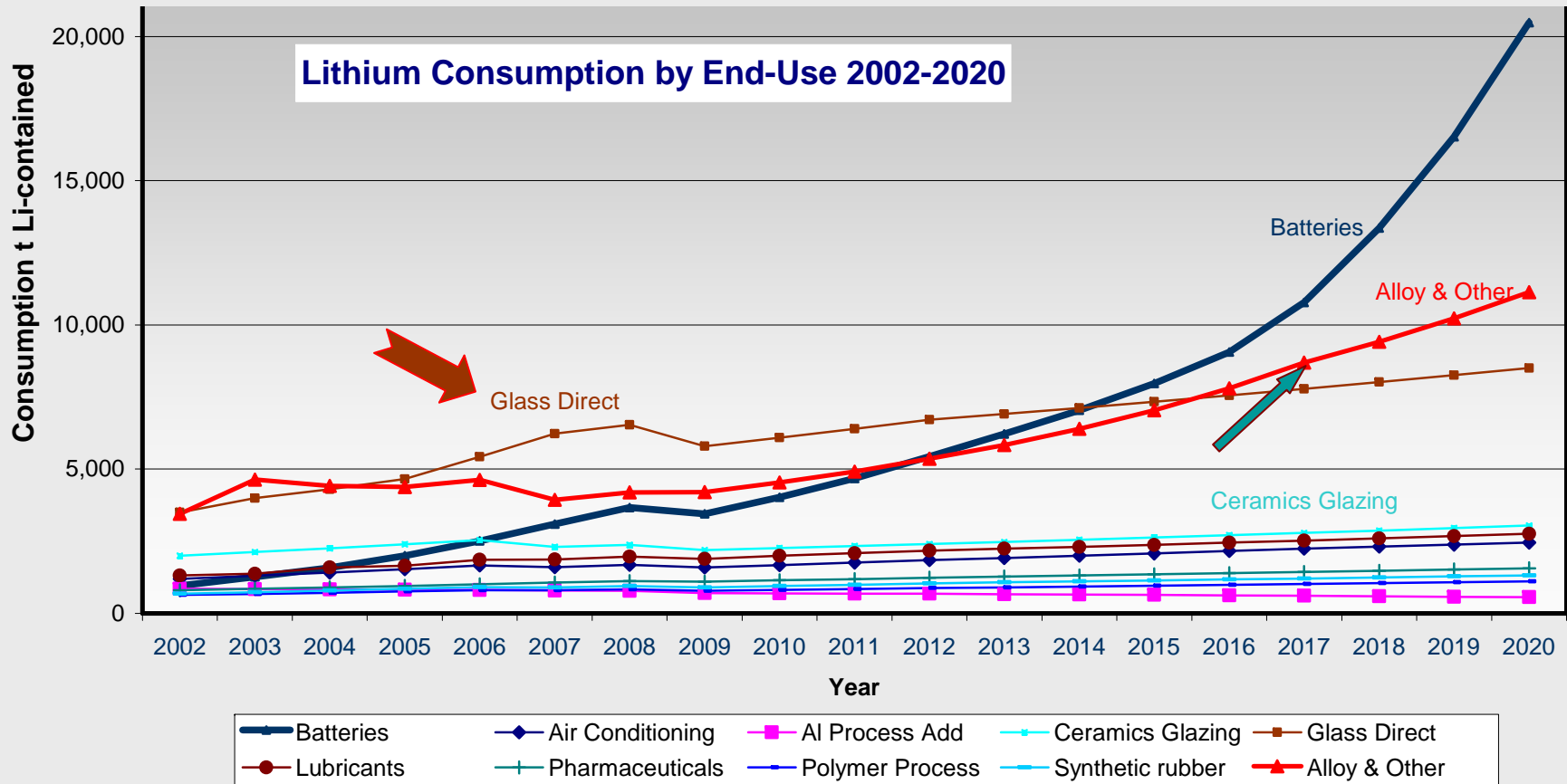
# Demand Curve



# Batteries Impact High



# User Segment Patterns



# Alloy Perspective

**by 2020 Alloy = 10% of total**

**Batteries = 14% NOW**

**Following Same Time Path?**

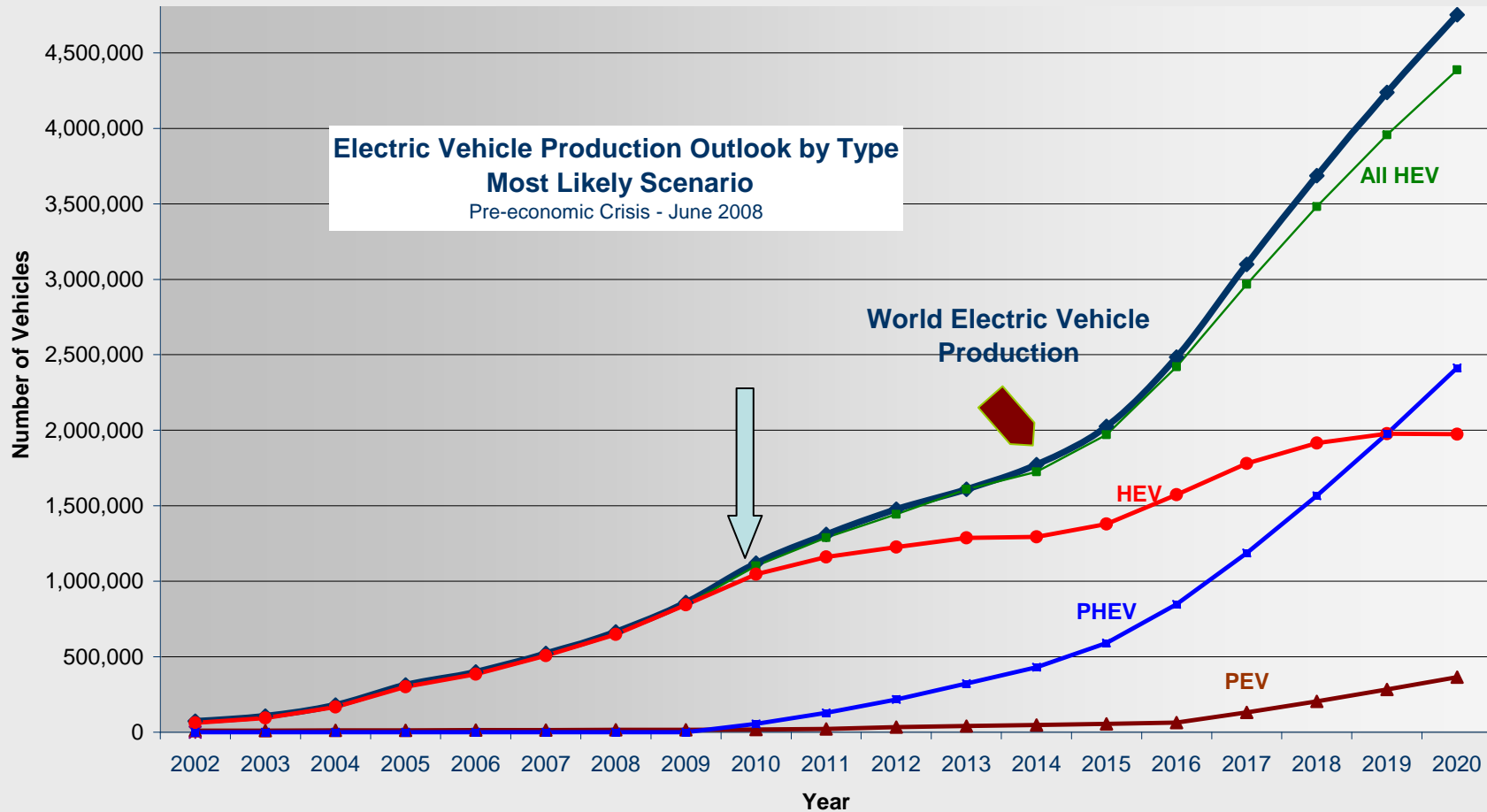


## Battery Use of Lithium by Type

Battery Type	2002	2007	2020	% Growth pa	
	% total	% total	% total	02 - 07	07-20
Primary Batteries	40%	21%	8%	11%	8%
Secondary Batteries	60%	79%	54%	33%	12%
EV Batteries	0%	0%	38%	71%	136%
<b>ALL BATTERIES</b>	100%	100%	100%	27%	16%

# Electric Vehicle Production Outlook by Type

TRU's Pre-Economic Crisis Forecast



World Electric Vehicle Production All HEV PEV Series5 HEV PHEV



# Electric Vehicle Li-Battery Development Fundamentals

## Electric Vehicle Type

Year Technical Issues  
Resolved for Lithium Battery

Hybrid Electric Vehicle	2011
Plug-in Hybrid Electric Vehicle	2014
Plug-in Electric Vehicle	2016
Fuel Cell Vehicles	2018

# User Segment Overview

USE SEGMENT	2002	2007	2020	% Growth t per annum	
	% total	% total	% total	02 - 07	07-20
Air Conditioning	8%	7%	5%	5.9%	3.4%
Aluminium Process Add	6%	3%	1%	-1.5%	-2.6%
Batteries	6%	14%	39%	26.5%	15.6%
Ceramics Glazing	13%	10%	6%	2.8%	2.2%
Glass/Ceramic Li Add	23%	28%	16%	12.2%	2.4%
Lubricants	9%	8%	5%	7.3%	3.0%
Pharmaceuticals	5%	5%	3%	6.0%	3.0%
Polymer Process	4%	4%	2%	4.6%	2.6%
Synthetic rubber	4%	4%	2%	5.8%	3.0%
Other Plus Alloy	22%	17%	21%	2.6%	8.3%
<b>ALL USES Li-contained</b>	100%	100%	100%	8.0%	6.8%
<b>Chemical Uses Demand</b>	<b>77%</b>	<b>72%</b>	<b>84%</b>	<b>6.6%</b>	<b>8.0%</b>
<b>Glass/Ceramics Direct</b>	23%	28%	16%	12.2%	2.4%

# Supply Classes




- i. Supply from Existing Plants**
- ii. Pipeline Projects Supply**
- iii. New Resource Supply**

# Notable Supply Drivers

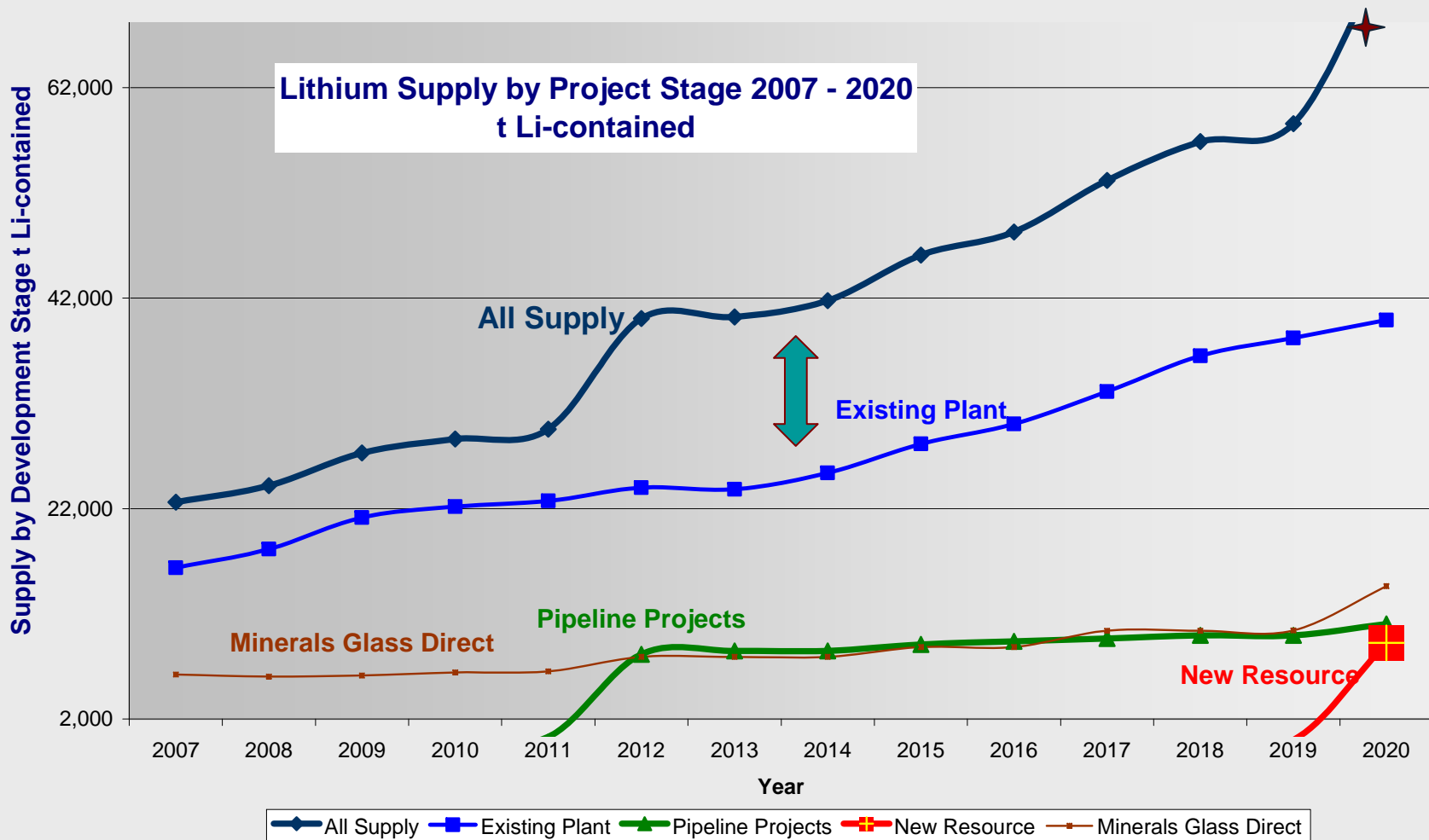
- i. **Existing low cost (brine-based) plants can expand significantly**
  
- ii. **Emerging technologies provide new options for medium-scale lithium developments \***
  
- iii. **Mineral-based supply (for basic Li chemicals) can be economic with price escalation**

*\* selective ion adsorption, electrodialysis, nanofiltration, etc*

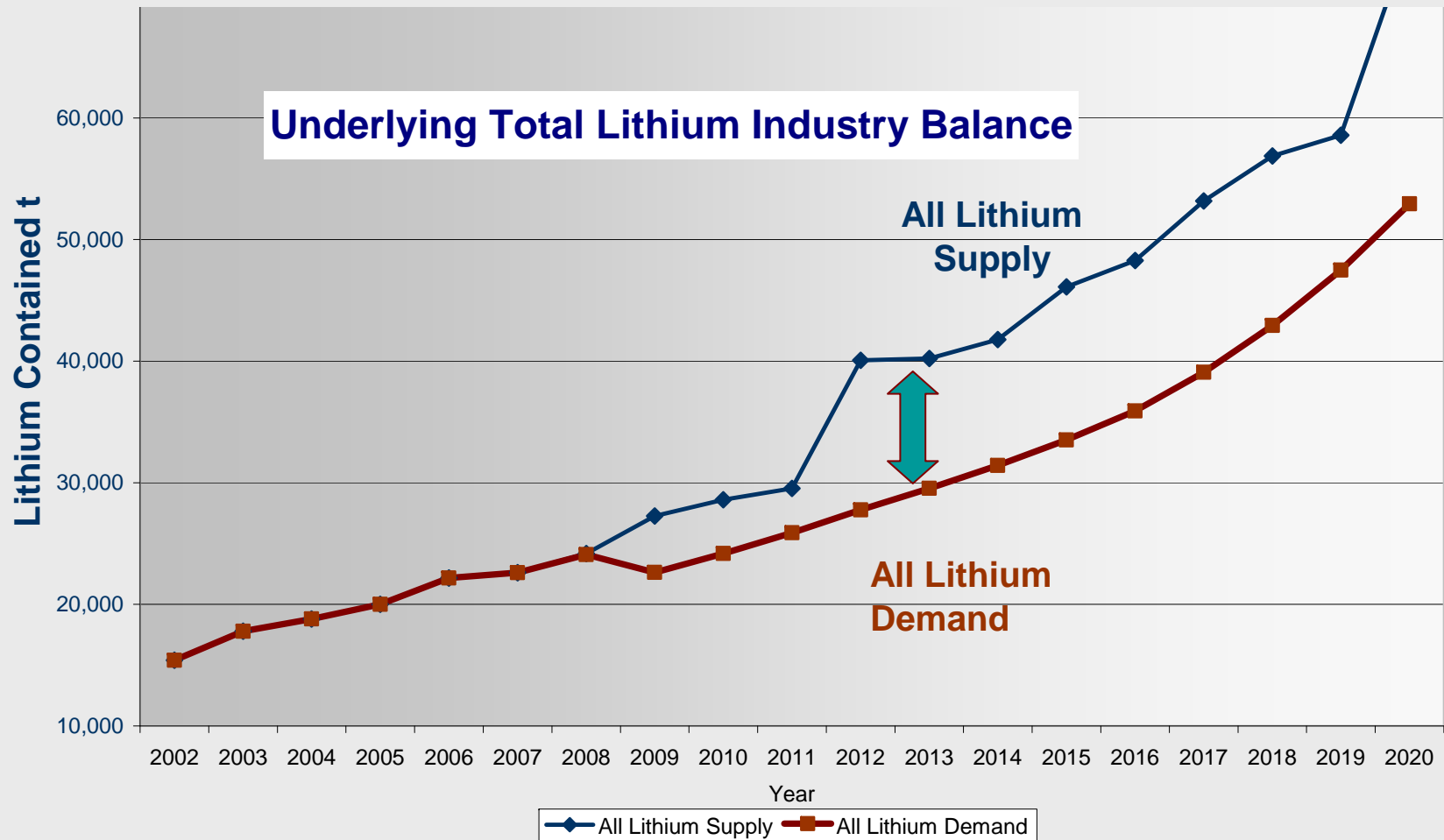
# Supply by Stage

Supply Stage	2002	2007	2017	2020	Average % Growth pa			
	% total	% total	% total	% total	02-07	07-12	12-17	17-20
Existing Plants	77%	72% 	62%	53%	7%	8%	7%	6%
Pipeline Plants	0%	0% 	18%	15%	-	-	3%	5%
New Resources	0%	0%	0%	12%	-	-	-	-
 Glass Use Direct	23%	28%	20%	20%	12%	5%	6%	12%
<b>Total Li Supply</b>	100%	100%	100%	100%	8%	12%	6%	12%

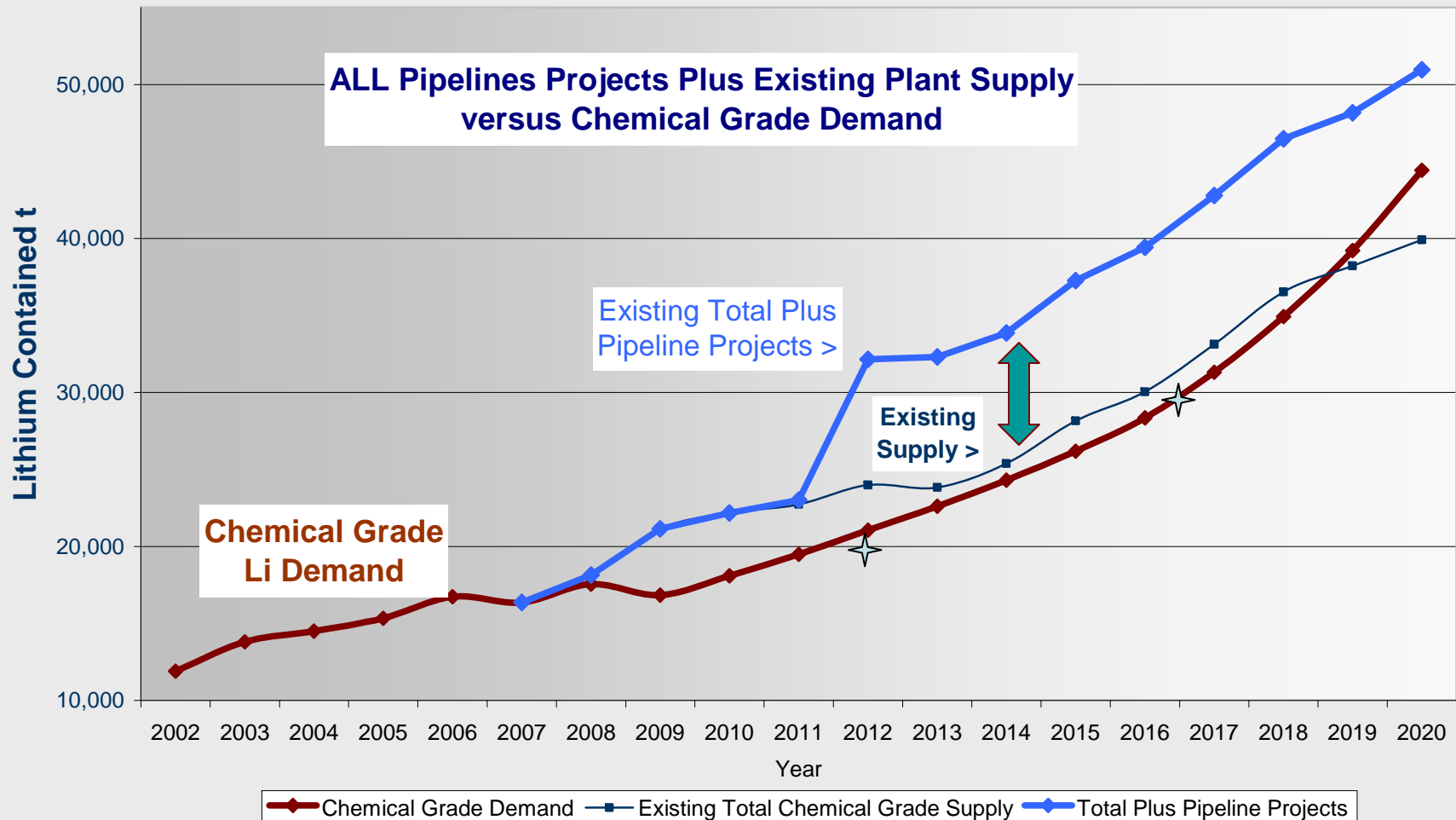
# Supply Pattern



# All Lithium Supply-Demand



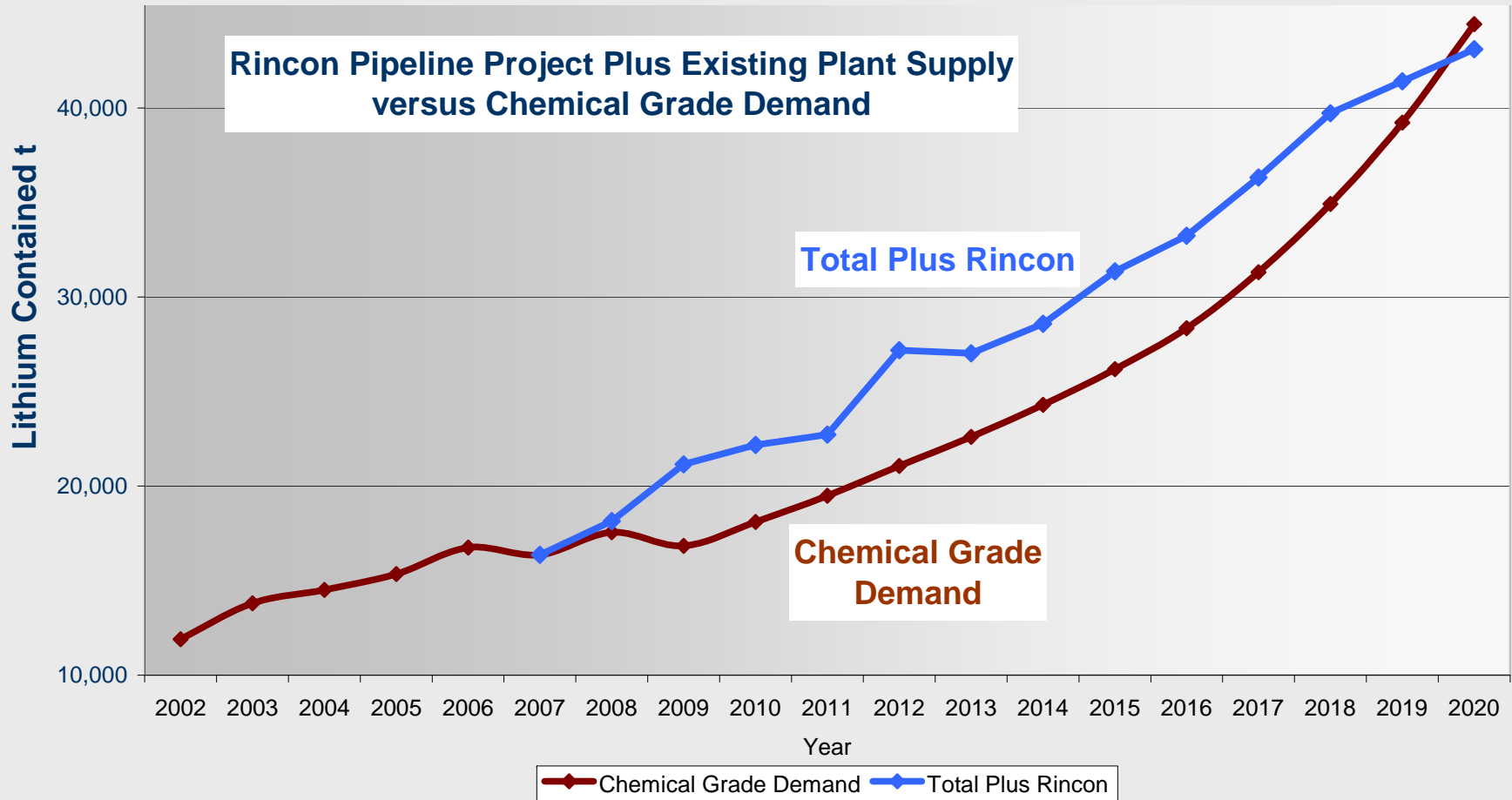
# Chemical Grade Lithium Supply Band vs. Demand



# Most Likely Scenario

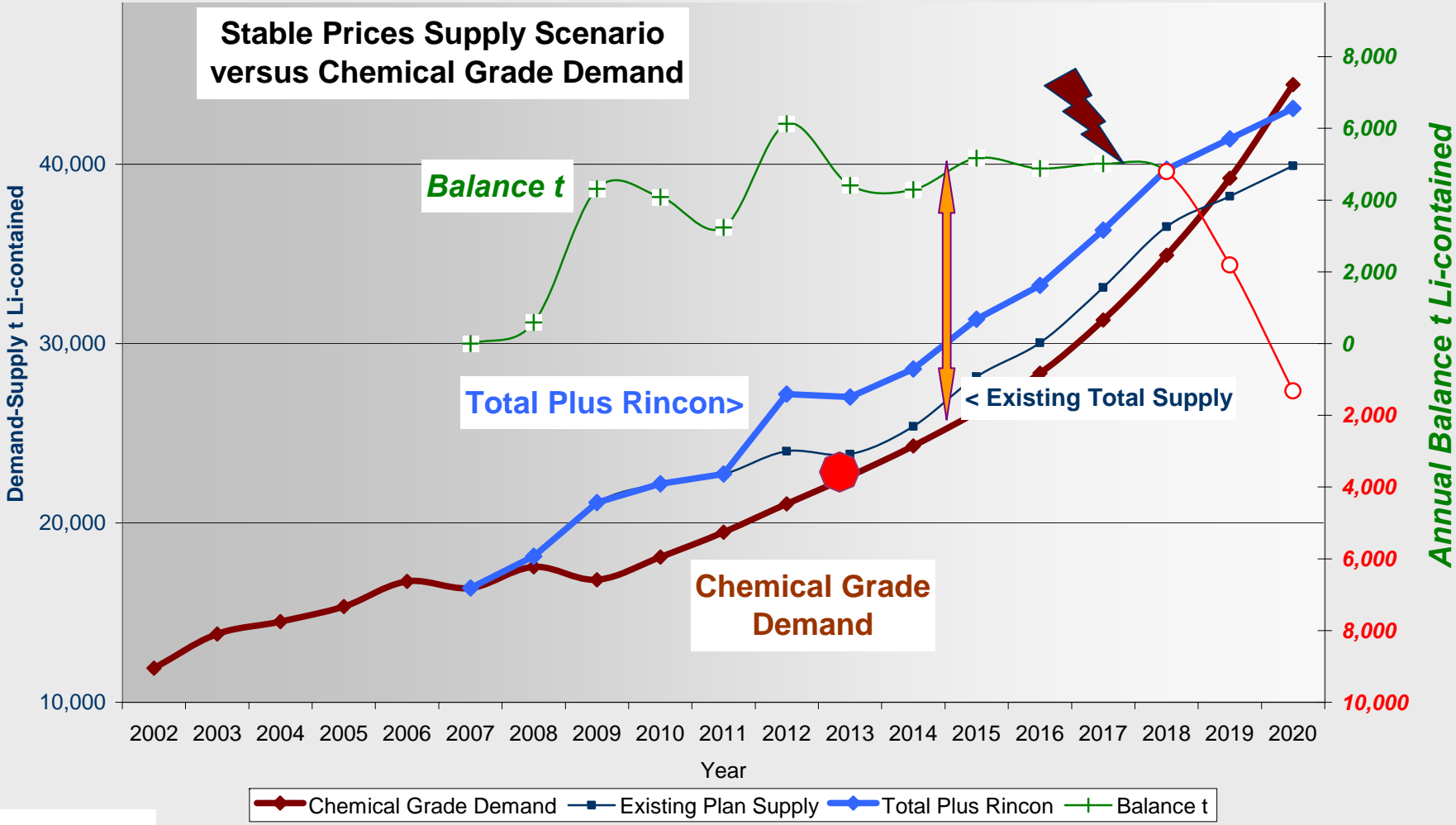
Stable Prices

## MOST IMPORTANT



# Lithium Market Balance

Stable Prices Scenario



# Prices Outlook 2020

Inserted November 18, 2009

## Model Suggests: “Stable Prices Scenario”

- ❖ Through 3rd-quarter 2009 prices flat but superficially bolstered by falling dollar
- ❖ SQM 20% reduction – falling prices consistent with TRU over-supply forecast
  - ❖ Stable prices expected long range 2020
- ❖ Transaction prices for lithium chemicals much lower than published by project promoters and ill-informed analysts

[Click for link to full price outlook comments](#)

# Summary Outlook 2020

Global Recession puts industry  
into over-supply through 2013

***Market returns to balance 2013-2017***

***In balance ≠ “Over Supply”***

**Critical years = 2017-2018**

Chemical Li Demand = Potential of Existing Producers



**Thank You !**

**Edward R Anderson**

B.Sc.(Hons)., Dpl.(Marketing Research)., MBA., FCI Arb  
President & CEO

**TRU Group Inc**

[trugroup.com](http://trugroup.com)

✉ [anderson@trugroup.com](mailto:anderson@trugroup.com)

Tucson 1-520-575-0674

Toronto 1-416-935-1754

Cell 1-520-229-7836

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