



# MEETING A LITHIUM FUTURE

Galaxy Resources Limited

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Managing Director

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EXCLUSIVE THE MOON SPECIAL ECONOMIC REPORT

# Canadian Business



**WEEKEND JOURNAL.**  
THE WALL STREET JOURNAL

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**MARKETPLACE**  
THE WALL STREET JOURNAL

**THE WALL STREET JOURNAL.**  
Wednesday, February 25, 2009

**What's News —**

**On the Rebound**  
**Fed's Surprise Rate Cut Sparks Rally**

Greenman's Show Makes Wall Street Caddy With the Dow Last  
Sounding the Fed

**Hot-Tasting TV Girl Makes a City Debate Limitations of Status**

**Two Airlines Push for Expansion**

**Recession**

**banks collapse!**

ALARMED: Fed Chairman Alan Greenspan.



# WHERE TO INVEST NEXT ?

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# BASE METAL PRICES

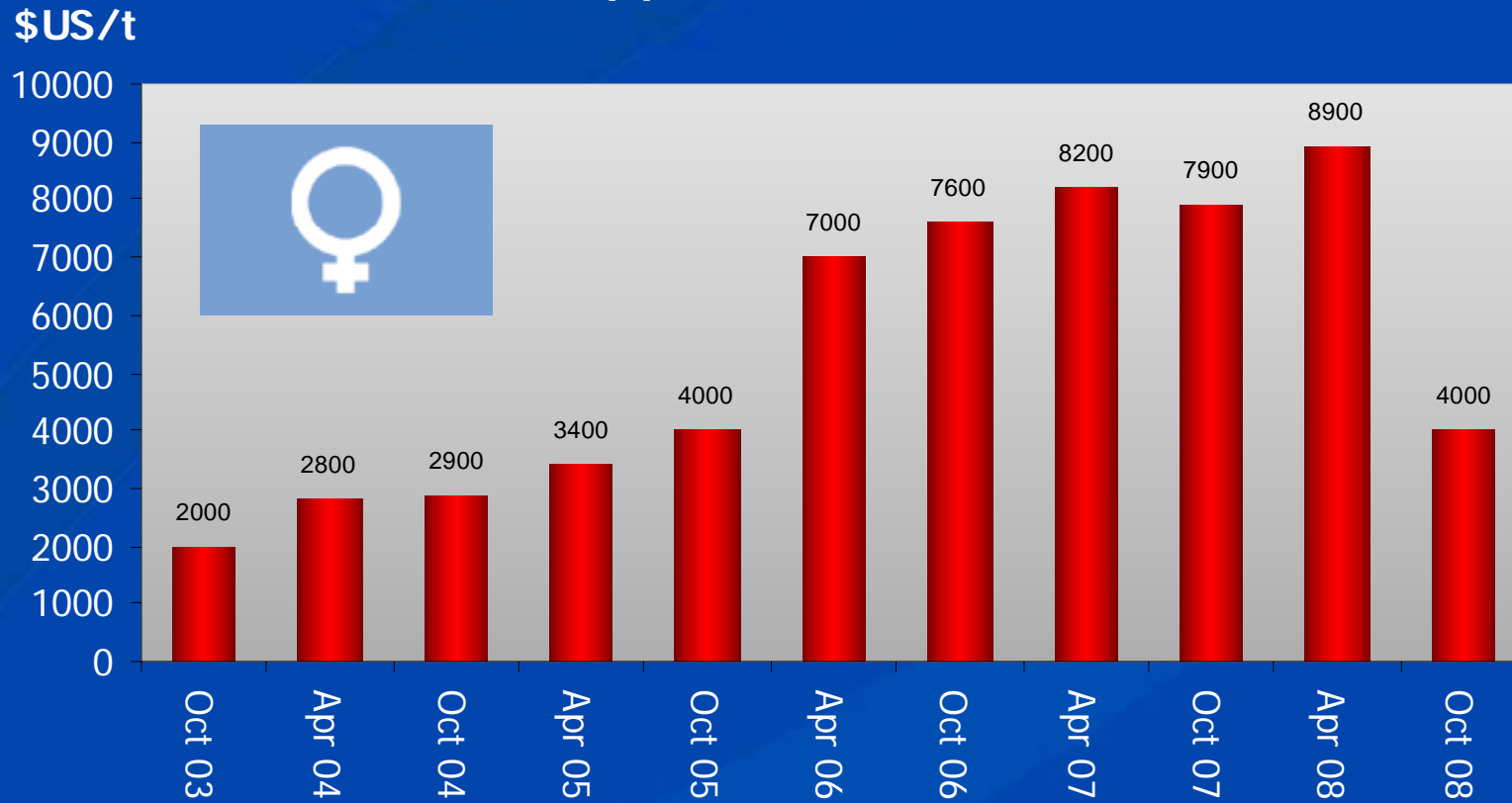
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## Zinc Price (\$US/t)



# BASE METAL PRICES

## Copper Price (\$US/t)



# BASE METAL PRICES

## Nickel Price (\$US/t)



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# BASE METAL PRICES

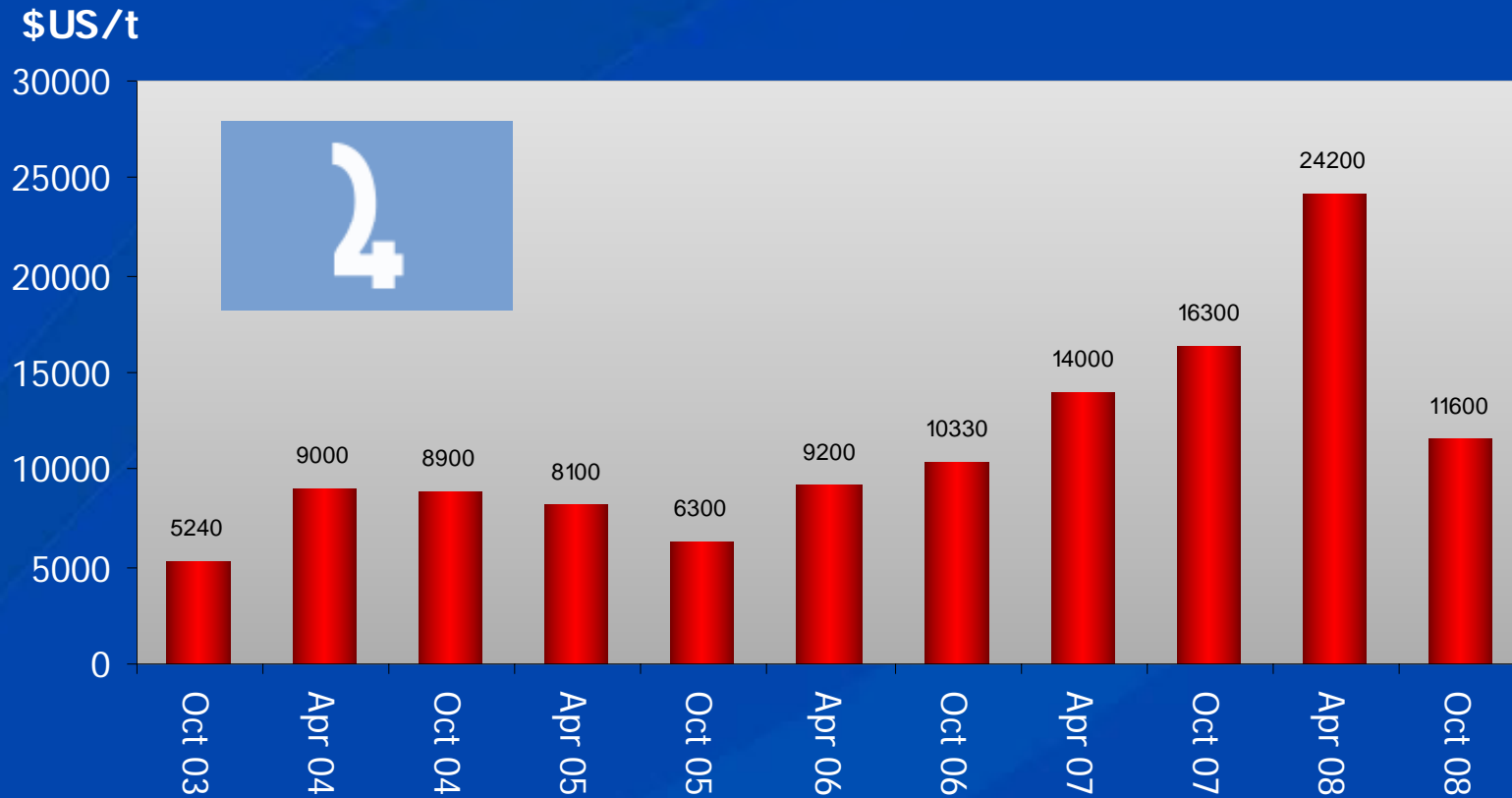
## Lead Price (\$US/t)





# BASE METAL PRICES

## Tin Price (\$US/t)



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# ORACLE FROM OMAHA

- ◆ Billionaire Warren Buffett's Berkshire Hathaway
- ◆ Mid American Energy Holdings Co
- ◆ 10% stake in BYD Co Ltd
- ◆ Lithium-ion battery & automobile producer
- ◆ Valued at \$US 230 million
- ◆ 7 bases - Guangdong, Beijing, Shanghai, & Xi'an
- ◆ BYD - Create a new era of world electric vehicles (F3DM)



*“We are thrilled to be partners with BYD and the people of China.” – Warren Buffett*

# END OF THE ROAD FOR GAS GUZZLERS

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November 2008  
[Automotive](#)

## End Of The Road

Faced with high oil prices and eco-anxiety, US carmakers are having to rethink their gas-guzzling ways and take some lessons from their European rivals, says Ben Oliver

# BYD DEVELOPMENT

- ◆ Electric power is only 1/3 of that of gasoline
- ◆ Top speed is over 150km/hr
- ◆ 0 to 100km/h in 13.5 seconds
- ◆ Car can travel over 300km / per charge
- ◆ Battery's life-cycle is about 2000 times
- ◆ 600,000km for a complete vehicle



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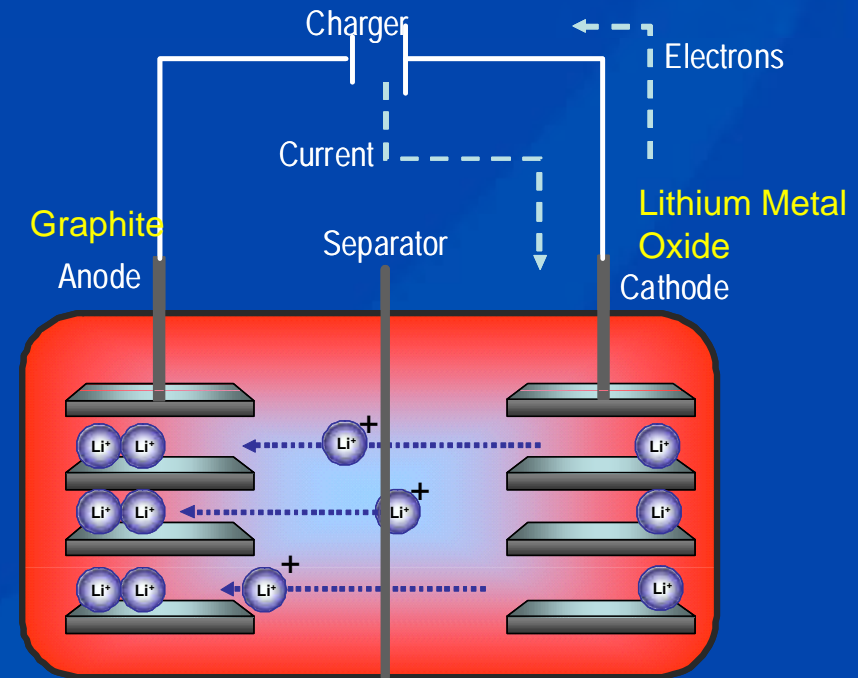
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# LITHIUM ION BATTERIES

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- ◆ Lead-acid, Ni-Cad & Ni-metal hydride
- ◆ Voltage – 3 times
- ◆ Pollution Free – no Cd, Pb, Hg
- ◆ Long Cycle Life- 500 charge/discharge
- ◆ No Memory Effect
- ◆ Fast Charge Capacity – 1-2 hours
- ◆ \$7.4 billion battery market
- ◆ 10-15% growth
- ◆ Nano porous silicon – 10x
- ◆ China pose to manufacture 40% Li-ion batteries within 10 years



# ELECTRIC VEHICLE REVOLUTION



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sunday, november 2  
**thedailygreen** the consumer's guide  
to the green revolution

## **Ener1 and Advanced Lithium-Ion Batteries Make Way for Electric Vehicle Revolution**

### **Charles Gassenheimer Hopes to Power Clean Cars**

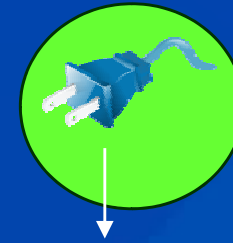
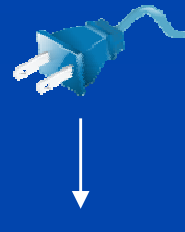
October 31, 2008 at 3:20PM by By Jim Motavalli

Can you feel the electricity? There's a growing consensus that the next generation of automobiles will, to one degree or another, be powered by batteries. The most likely

fast charging cycles. Li-ion has also had stability issues -- remember those Sony laptop fires? Well, that company just recalled 100,000 more laptop li-ions because of fire hazards.

# ELECTRIC VEHICLE REVOLUTION

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Green Power



Automobiles

Hybrids

Plug In Hybrids

Plug In Electric

Emissions → Reduced Emissions → Zero Emissions

→ Increasing Use of Lithium





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# GROWTH OF ELECTRIC VEHICLES

- ◆ McKinsey - Venture investment \$153m 2002 → \$1.15b in 2007
- ◆ Most major automakers - researching and improving battery technology
- ◆ Volkswagen has teamed up with Sanyo
- ◆ Toyota with Matsushita Electric
- ◆ Nissan and NEC
- ◆ Ford & Honda with Sanyo
- ◆ General Motors with LG Chem / A123 Systems

*Isn't it totally feasible that we run out of lithium someday just like we are running out of gasoline?*

*“ - A Cefali Oct 2008*

# BETTER PLACE

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- ◆ Shai Agassi (Founder)
- ◆ End Oil, 0 Emissions, Renewable
- ◆ Electric vehicles been around
- ◆ Range and cost of battery
- ◆ 100 mile range
- ◆ Plug in where you park - 95%
- ◆ Battery exchange stations
- ◆ Better place owns the batteries
- ◆ Partners AESC (Nissan, NEC)



# BETTER PLACE

- ◆ Renewable Energy
- ◆ 700 million cars
- ◆ Reduce carbon footprint 10%
- ◆ Recharge grid
- ◆ Demand, storage, support
- ◆ Off peak power a place to go
- ◆ Storage system
- ◆ \$1 billion raised



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# TYPICAL DEVELOPMENT

- ◆ Electric cars are no longer the stereotype
- ◆ BMW Group - electrically-powered MINI E
- ◆ Electric drive train - peak torque of 220 Nm
- ◆ 100km/hr in 8.5 sec
- ◆ Top speed 152 km/hr
- ◆ Lithium-ion battery unit - 35 kWh
- ◆ 500 cars - Oxford & Munich sites end of 2008



BMW Mini



Porsche 996



GM Chevrolet Volt



Subaru R1e

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# GROWTH OF ELECTRIC VEHICLES

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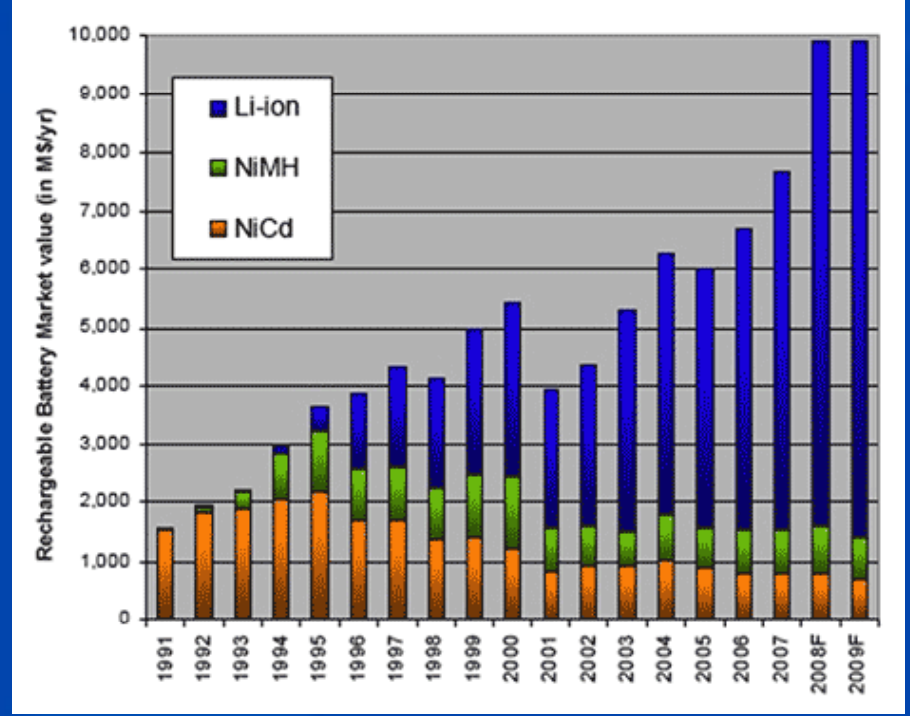
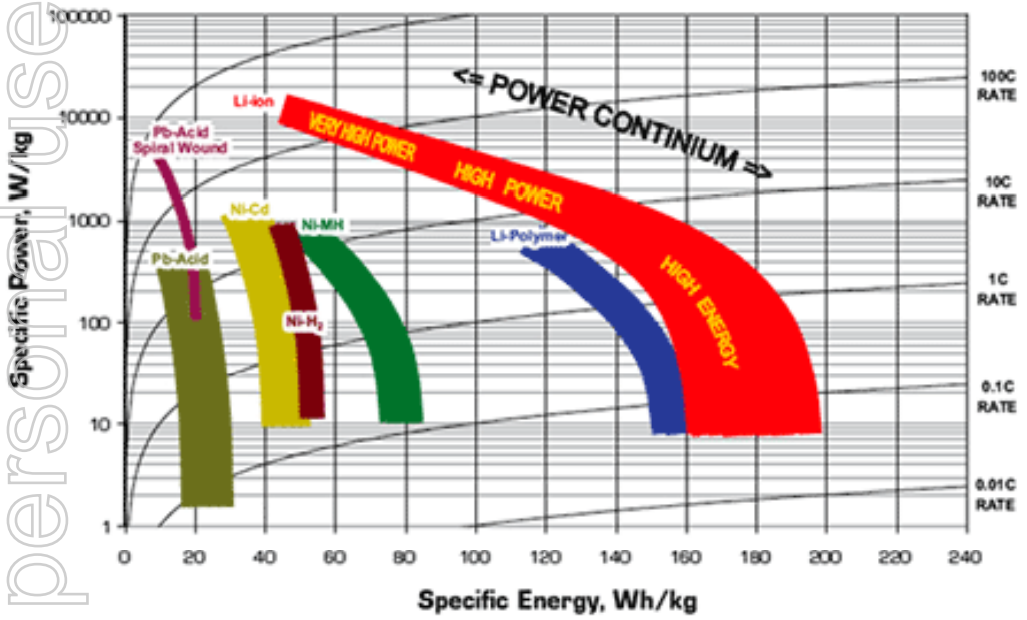
“1 million plug in hybrids  
electric vehicles on the  
road by 2015”

\$300 billion ‘greentech’  
revamp of American  
industry

# BATTERY DEVELOPMENT

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**SPECIFIC POWER/SPECIFIC ENERGY OF RECHARGEABLE CELLS**



# GROWTH OF ELECTRIC VEHICLES



*“Could we not be swapping dependence on one depleting natural resource, oil, for another?”*

*Analysis shows that a world dependent on lithium for its vehicles could soon face even tighter resource constraints than we face today with oil.”*

*William Tahil Research Director, Meridian International Research*

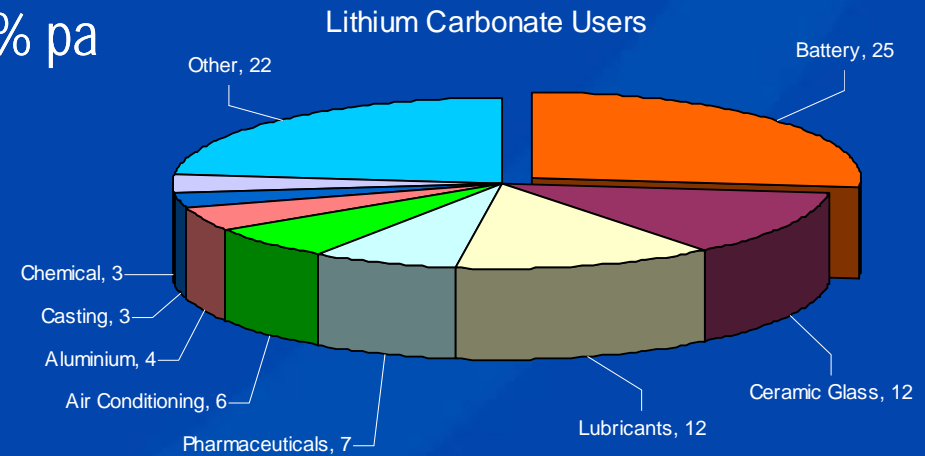
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# LITHIUM CARBONATE (Li<sub>2</sub>CO<sub>3</sub>)

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- ◆ Current Li<sub>2</sub>CO<sub>3</sub> 2007 production 93,000 tpa
- ◆ 2010 expect to be 153,000 tpa
- ◆ Demand 2007 of 20%, mid term of 10% pa
- ◆ Lithium ion batteries
- ◆ 7.5 Kg Li<sub>2</sub>CO<sub>3</sub> per small car
- ◆ 60 mil cars produced each year
- ◆ Demand of 420,000 Li<sub>2</sub>CO<sub>3</sub> tpa
- ◆ 6 times world production
- ◆ Expect to transfer to price growth



# the **INQUIRER**

News, reviews, facts and friction

## **Lithium supply in danger**

### **Start panicking people**

By [Emma Hughes](#): Friday, 31 October 2008, 12:30 PM

**WHEN WE THINK** of electric cars, we usually think of greener energy and saving the environment – yet now boffins are saying that these vehicles could come at significant cost to the environment.

The type of batteries used for electronic gadgets such as laptops, are the very same as those proposed for electric and plug in hybrid cars – lithium ion batteries.



## **Ener1 Signs Memorandum of Understanding with Leading Japanese Power and Utility Provider**

**Ener1 and Kyushu Electric Power to Co-Develop Rapid Re-Charging Stations for Next-Generation Electric Vehicles**

By: [PR Newswire](#)

The target date to have the first integrated systems available is by March, 2009. The relationship will accelerate the development and diffusion of charging systems to match the anticipated growth in electric vehicles. The ability to rapidly recharge lithium-ion batteries will be crucial in enabling the widespread adoption of the electric vehicle, and it is anticipated that these systems will allow customers to recharge up to 80% of their vehicle's battery capacity in less than 20 minutes.

News Site of the Year | The 2008 Newspaper Awards

# TIMES ONLINE

From The Times  
November 6, 2008

## Japanese industry set for a lithium rush as carmakers turn focus to green motoring

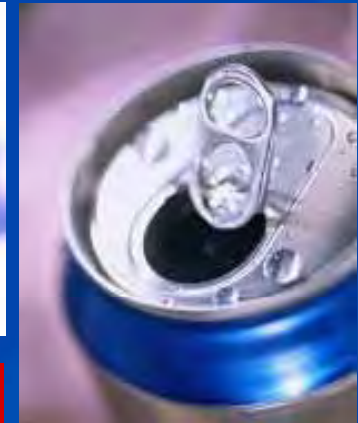
Leo Lewis, Asia Business Correspondent

Japan's largest automotive and electronics giants are poised to embark on a worldwide scramble for lithium - the material that could be required in bulk if the roads of the future are to be filled with electric cars.

In addition to the emerging pursuit of lithium, Japanese trading companies have begun an energetic land-grab for other types of mines: bauxite, platinum and nickel are prime targets because of the huge demand from Japanese industry.

# LITHIUM CARBONATE (Li<sub>2</sub>CO<sub>3</sub>)

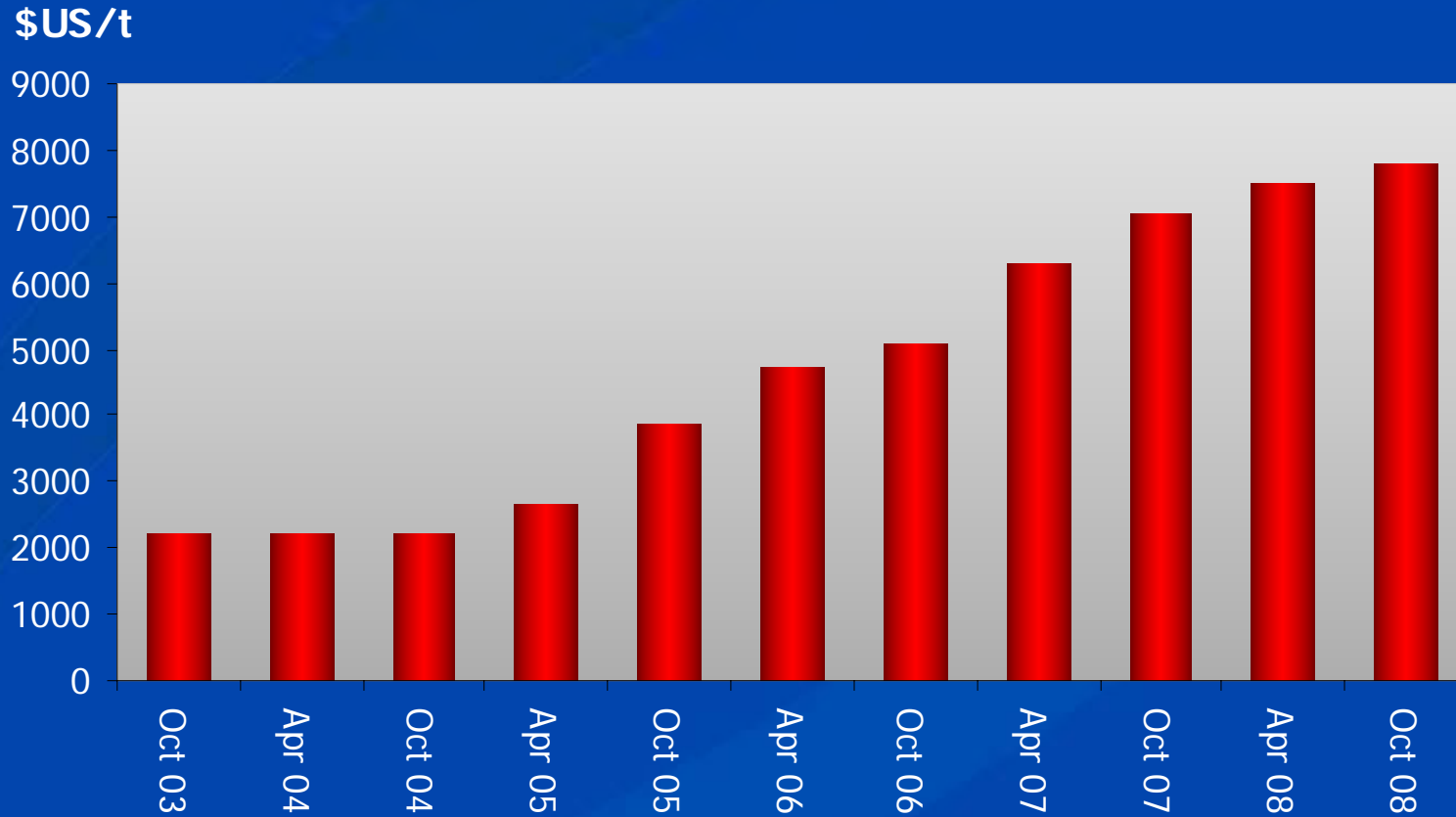
- ◆ Manufacture of other lithium salts
- ◆ Pharmaceuticals
- ◆ Fuel cells, electricity cogeneration
- ◆ Glass industry & optics screens
- ◆ Enamels, iron coating
- ◆ Glass ceramics, telescope mirrors
- ◆ Aluminium production
- ◆ Construction, concrete
- ◆ Lithium ion/polymer batteries



# INDEPENDENT OF BASE METALS



## Lithium Price (\$US/t)



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# SOURCES OF LITHIUM

## Brines

- ◆ Lithium Carbonate
- ◆ South America, Chile, China
- ◆ Solar evaporation ponds
- ◆ Cheaper but depleting
- ◆ Political & sovereign risk



## Hard Rock (Pegmatite)

- ◆ Most common spodumene
- ◆ Western Australia, Canada, Finland, Zimbabwe
- ◆ Cons → Chemical process
- ◆ Less sovereign risk



# LITHIUM BRINE SOURCES

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Israel

China

China

China

Oregon

Nevada

California

Bolivia

Chile

Argentina

Argentina

● Brine Deposits





# LITHIUM HARD ROCK SOURCES

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# WHO IS GALAXY RESOURCES?



- ◆ Industrial Mineral Focussed
- ◆ Exciting Potential
- ◆ Meeting a lithium future
- ◆ Lithium Ion Batteries
- ◆ Electric Vehicles
- ◆ Sustained Growth Cycle
- ◆ Early cash flow strategy



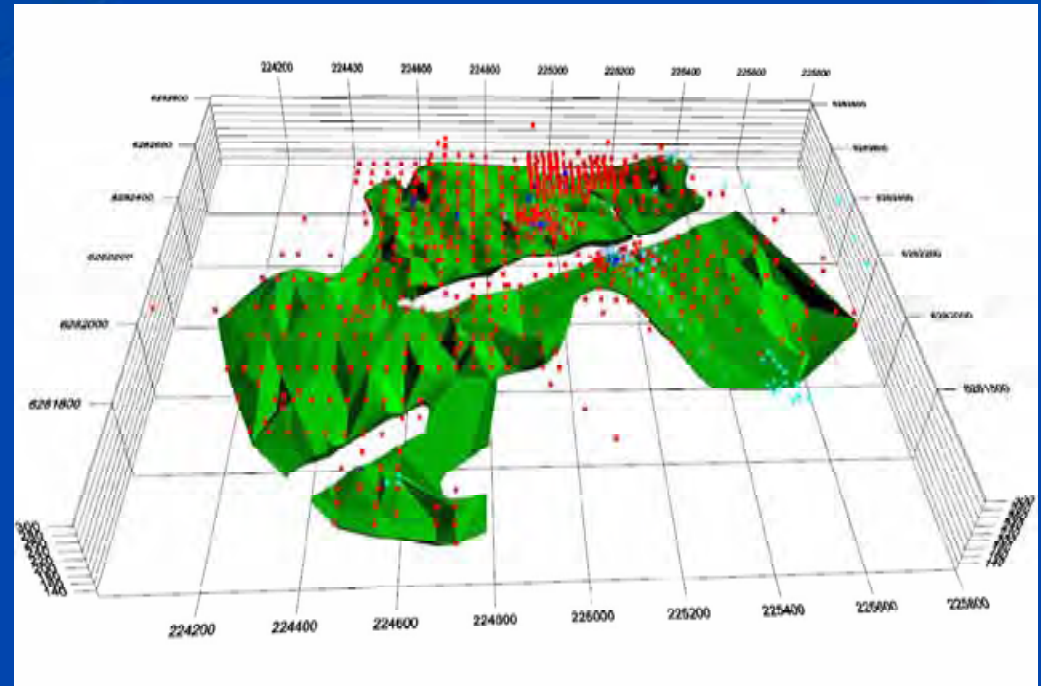
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# COMPANY MAKER

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- ◆ Mt Cattlin Li Ta Project
- ◆ Low Lying Pegamatite
- ◆ 1 Mtpa processing
- ◆ 140 ktpa Spodumene
- ◆ Capital around \$40m
- ◆ Payback of < 3 years

Subject to finalisation of BFS



# IDEAL LOCATION

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- ◆ Close to infrastructure
- ◆ Ravensthorpe township
- ◆ \$2.3b BHP Nickel Operations
- ◆ Close to Esperance port
- ◆ Deposit on farm land
- ◆ Minimal environmental impact
- ◆ Easily upgradable ore



Figure 1

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# MINERAL RESOURCE ESTIMATE



## Mineral Resource (JORC)

	tonnes	Ta <sub>2</sub> O <sub>5</sub> ppm	Li <sub>2</sub> O %
Measured	1,090,066	177	1.07
Inferred	6,417,133	125	1.02
Indicated	4,797,911	140	0.96
Total	12,305,110	135	1.00

Cut off grade 0.4% Li<sub>2</sub>O

# WA PEGMATITES

## Greenbushes

- ◆ Incline vein pegmatite
- ◆ Head Grade 3% Li<sub>2</sub>O
- ◆ Glass & chemical grades
- ◆ Cut back costs



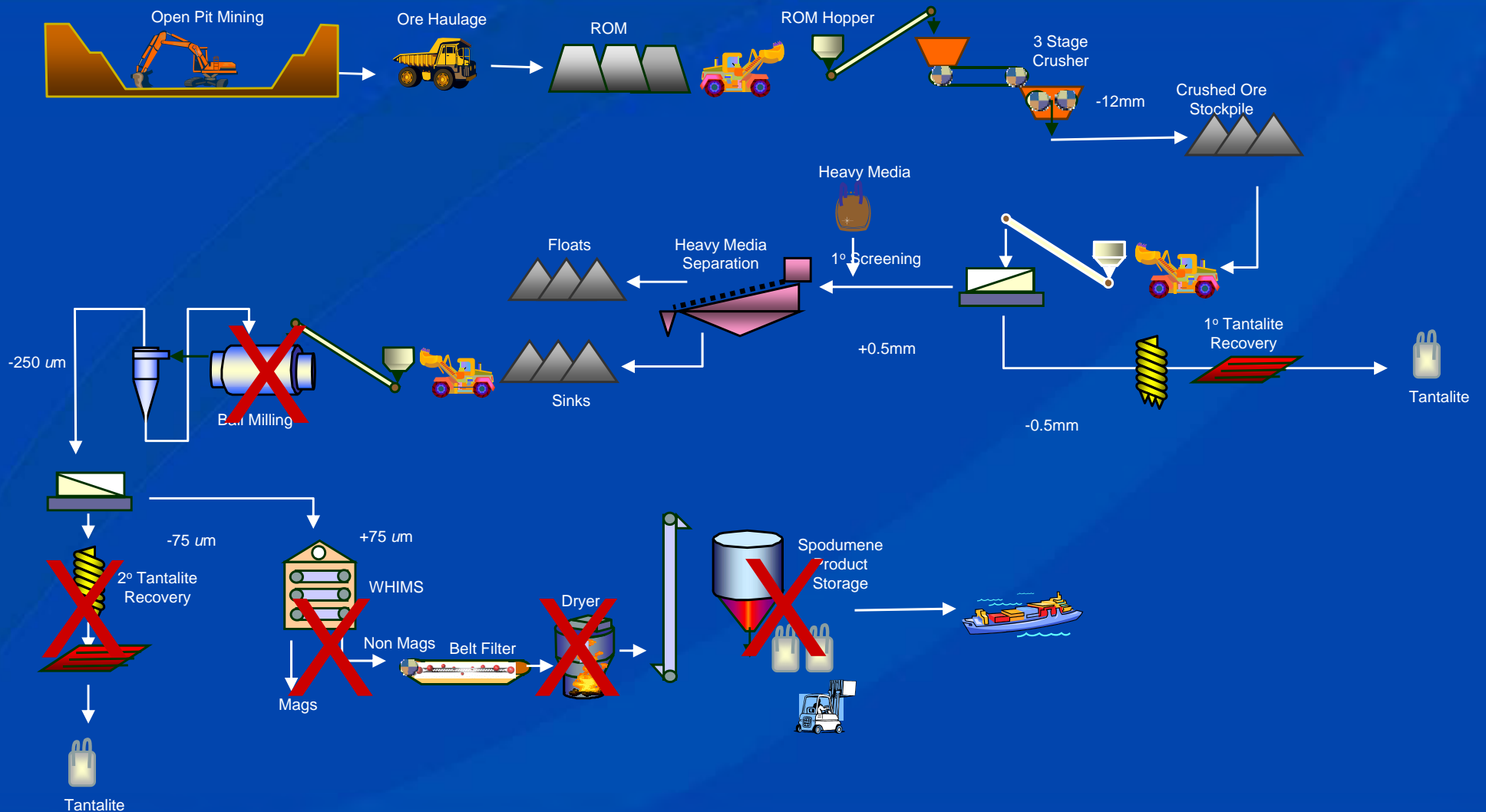
## Mt Cattlin

- ◆ Flat lying pegmatite
- ◆ Head Grade 1% Li<sub>2</sub>O
- ◆ Only chemical grade
- ◆ Low Strip ratio
- ◆ Easy upgradable



# PFS MINERALS FLOW SHEET

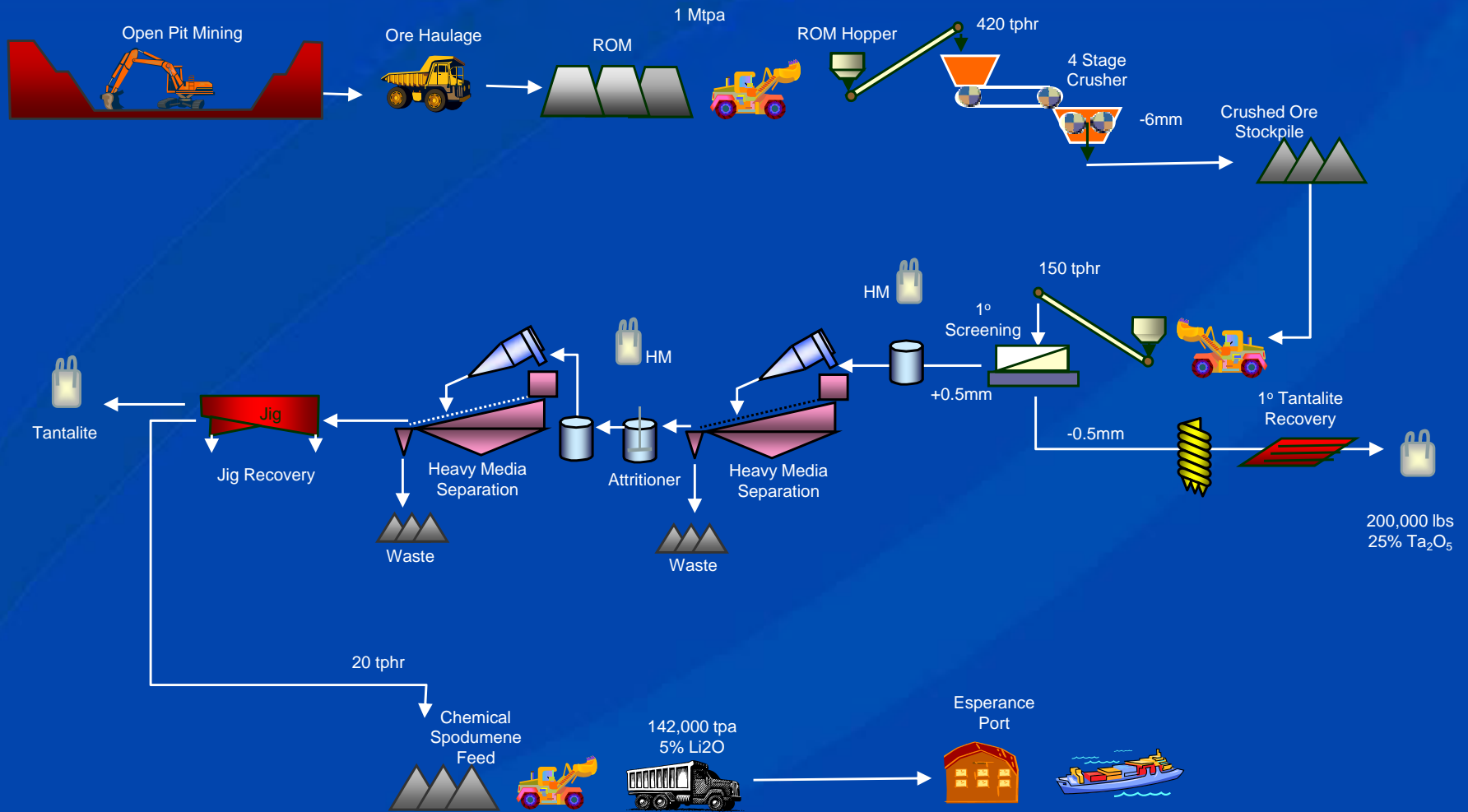
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# MORE STREAMLINE FLOWSHEET

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Trucking from town shed

Proposed Loading Point



# FEASIBILITY STUDY UPDATE

## PFS

- ◆ 1 mil tpa @ 1.0% Li<sub>2</sub>O
- ◆ 116,666 tpa @ 6% Li<sub>2</sub>O
- ◆ 364 tpa tantalite @ 25% Ta<sub>2</sub>O<sub>5</sub>
- ◆ 15 Year mine life
- ◆ Capex of \$40 mil
- ◆ Opex of \$33 /t ore
- ◆ Glass, chemical grade
- ◆ Bagged product
- ◆ FX Rate at \$US 0.90

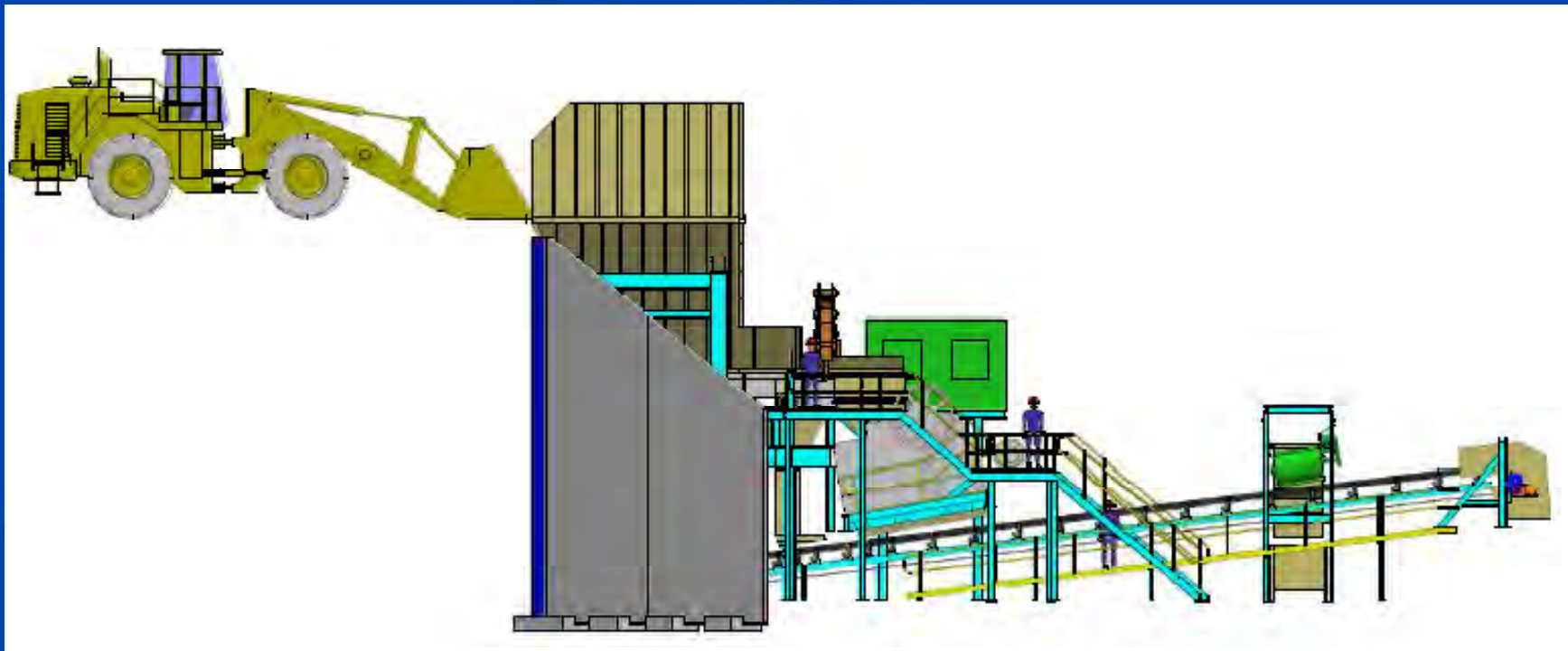
## BFS \*

- ◆ 1 mil tpa @ 0.95% Li<sub>2</sub>O
- ◆ 142,000 tpa @ 5% Li<sub>2</sub>O
- ◆ 224 tpa tantalite @ 25% Ta<sub>2</sub>O<sub>5</sub>
- ◆ 15 Year mine life
- ◆ Capex of \$40 mil \*
- ◆ Opex of \$33/t ore \*
- ◆ Chemical grade
- ◆ Bulk shipment
- ◆ FX Rate at \$US 0.73
- ◆ Payback < 3 years \*

\* To be confirmed on completion of BFS

# BFS DESIGNS

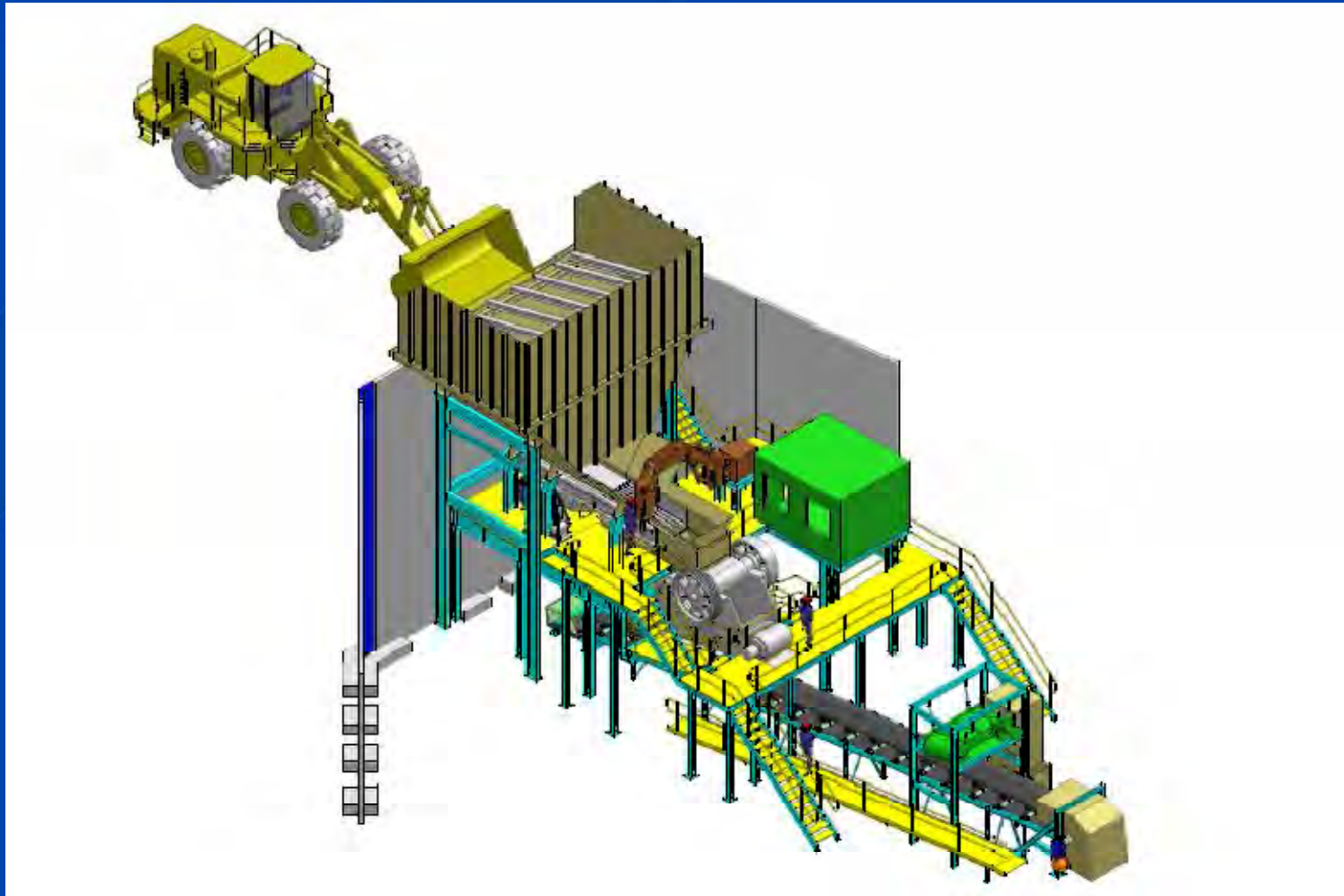
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PRIMARY CRUSHING- ELEVATION

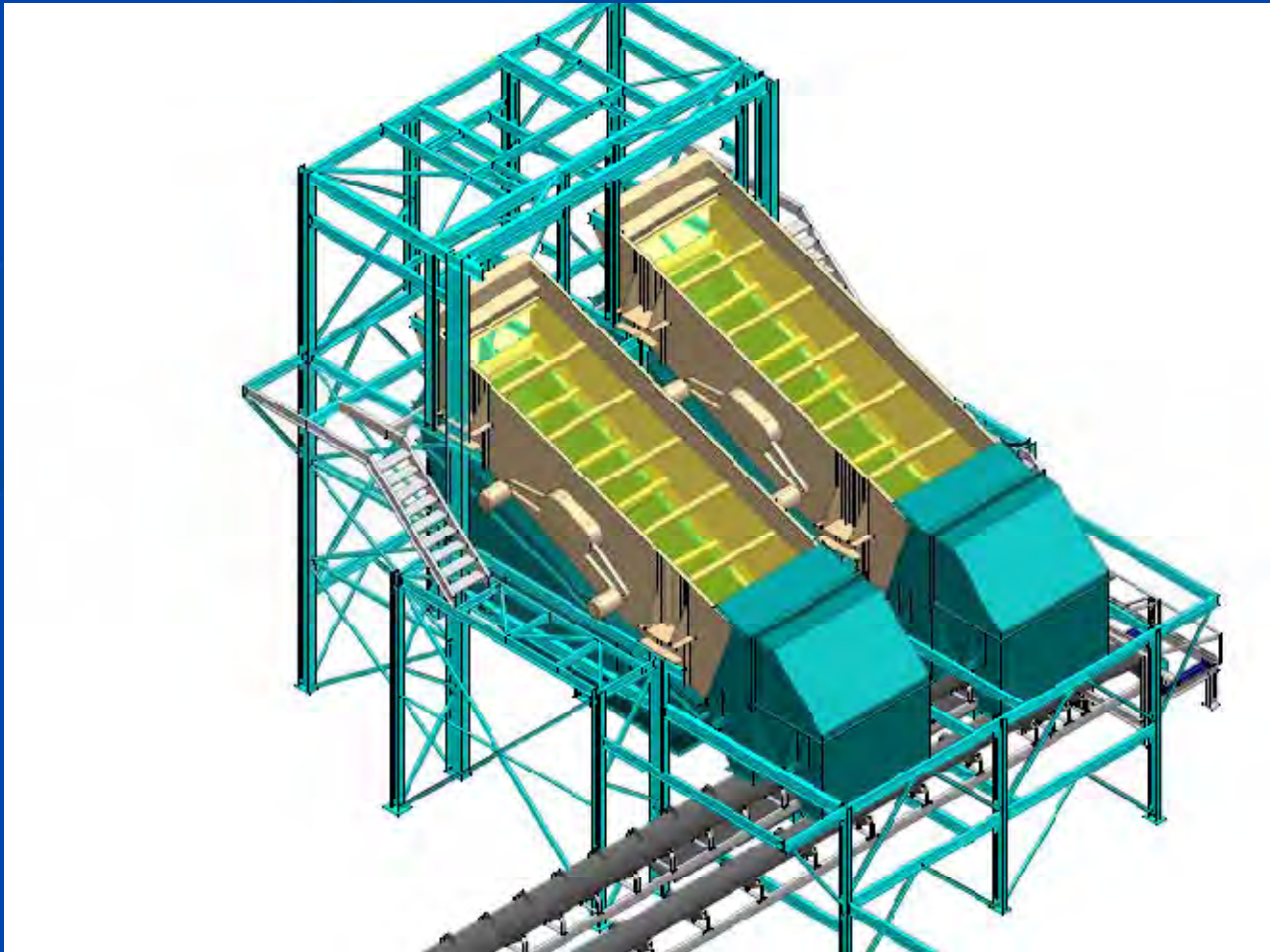
# BFS DESIGNS

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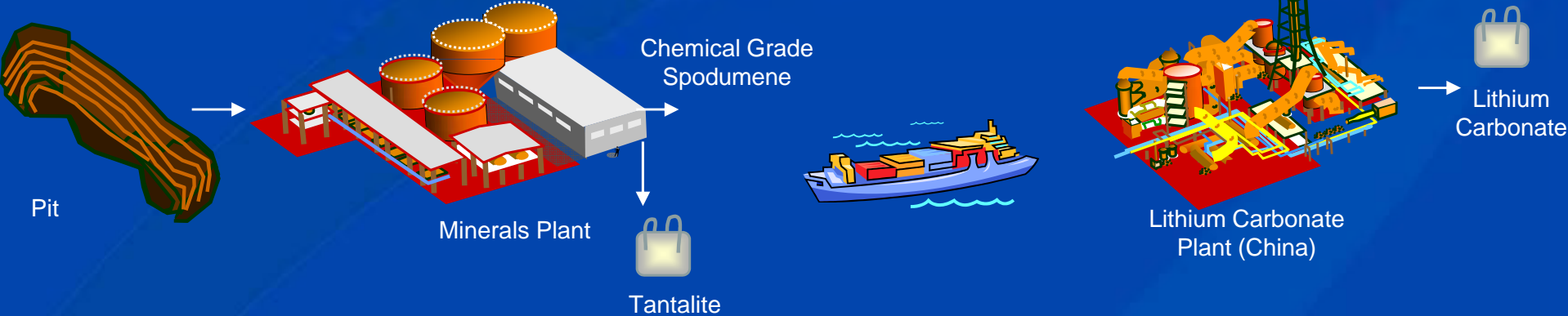
# BFS DESIGNS

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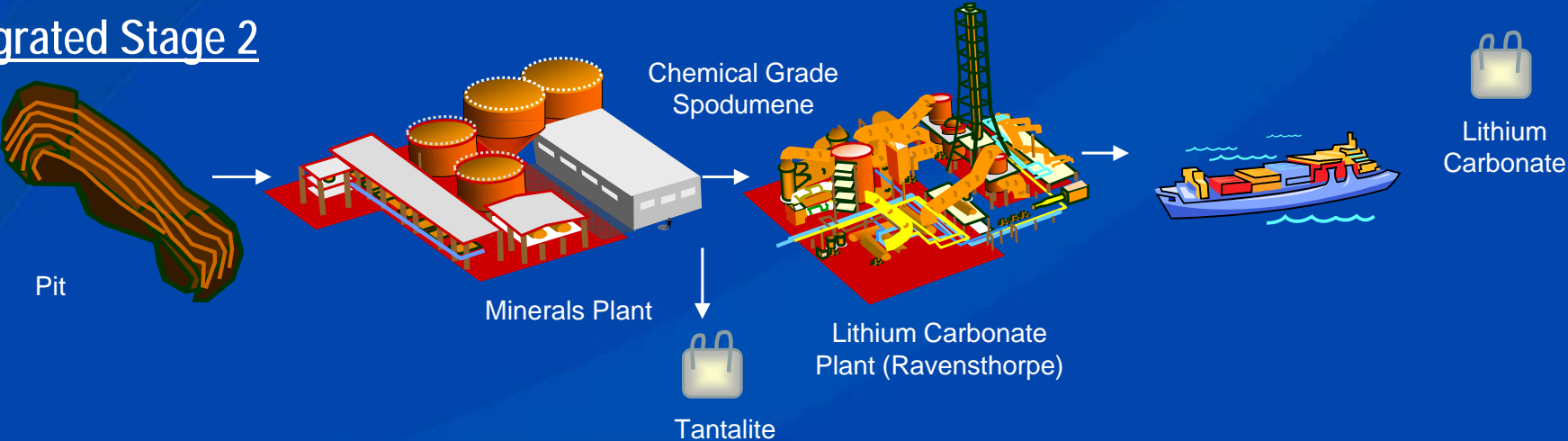


# EARLIER CASH FLOW STRATEGY

## Stage 1

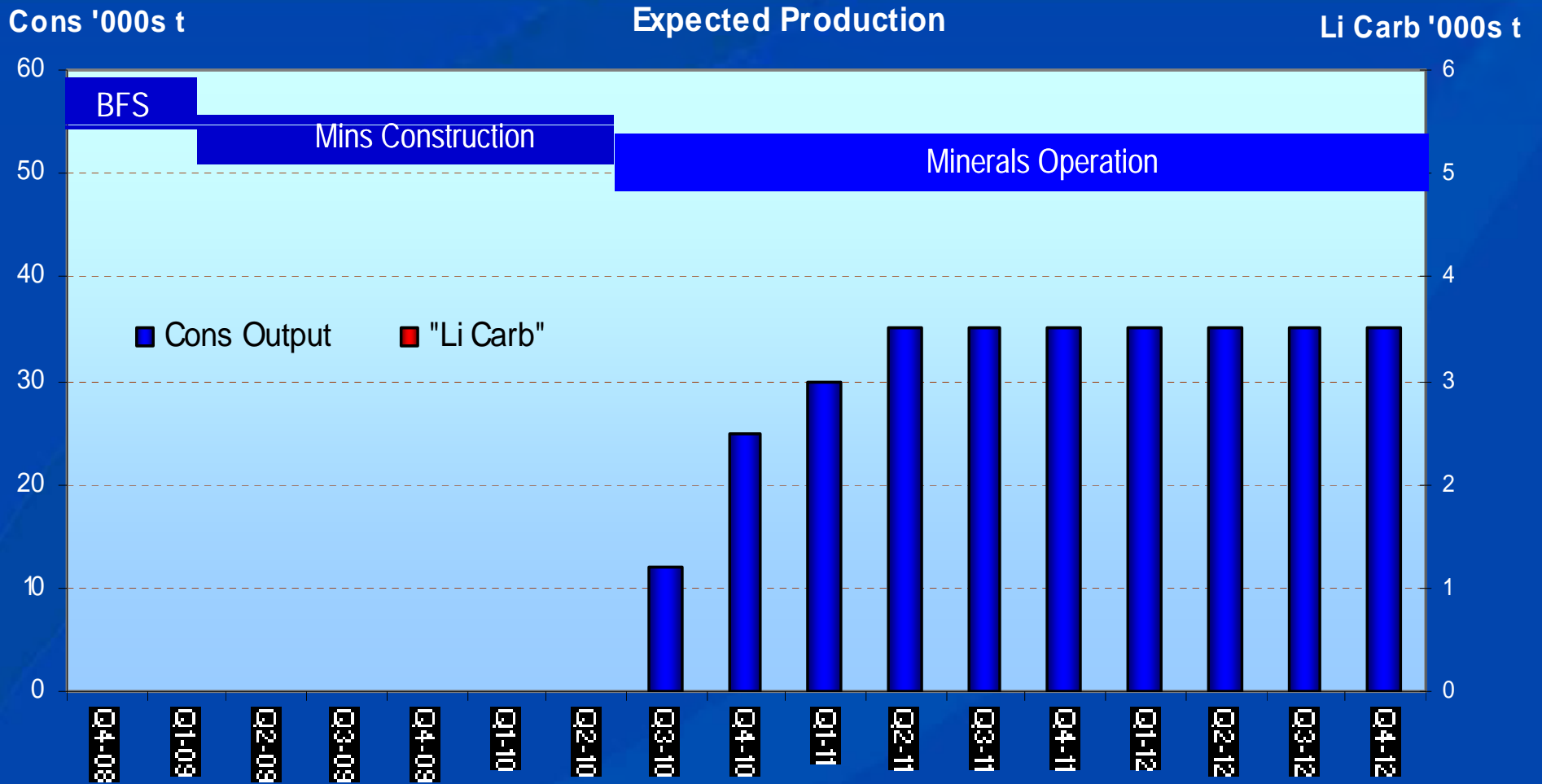


## Integrated Stage 2



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# EXPECTED PRODUCTION



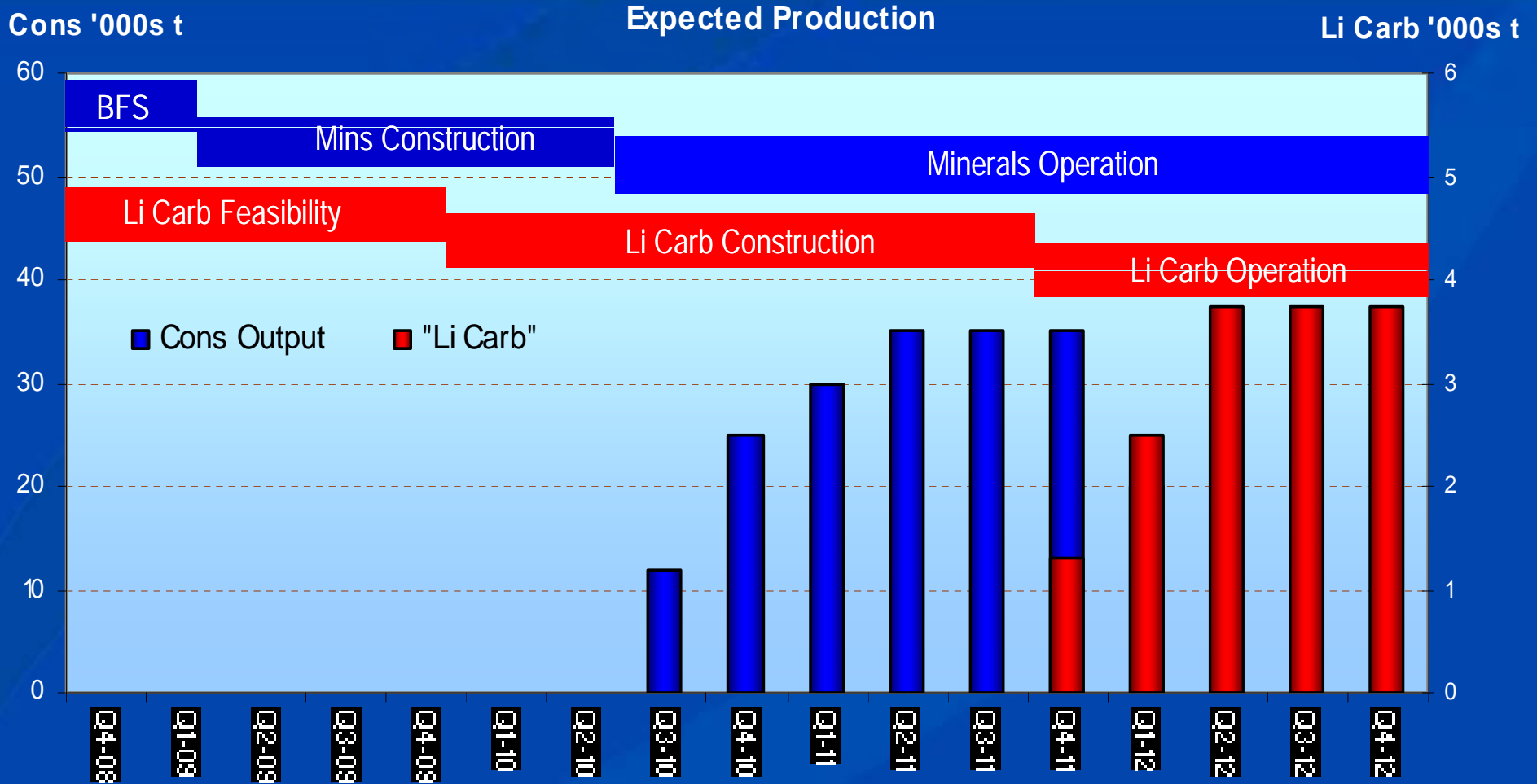
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# EXPECTED PRODUCTION



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# IS IT THE RIGHT TIME?

- ◆ Current downturn creates opportunities
- ◆ Projects are cheaper to build
- ◆ Operating costs are reducing
- ◆ Shipping & transport costs are reducing
- ◆ Competition for labour, project development
- ◆ Aluminum projects built cheaply in a downturn
- ◆ Anticipate huge lithium growth and demand
- ◆ NOW is the RIGHT TIME for Galaxy !



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# LITHIUM CARBONATE DEVELOPMENT

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Outotec



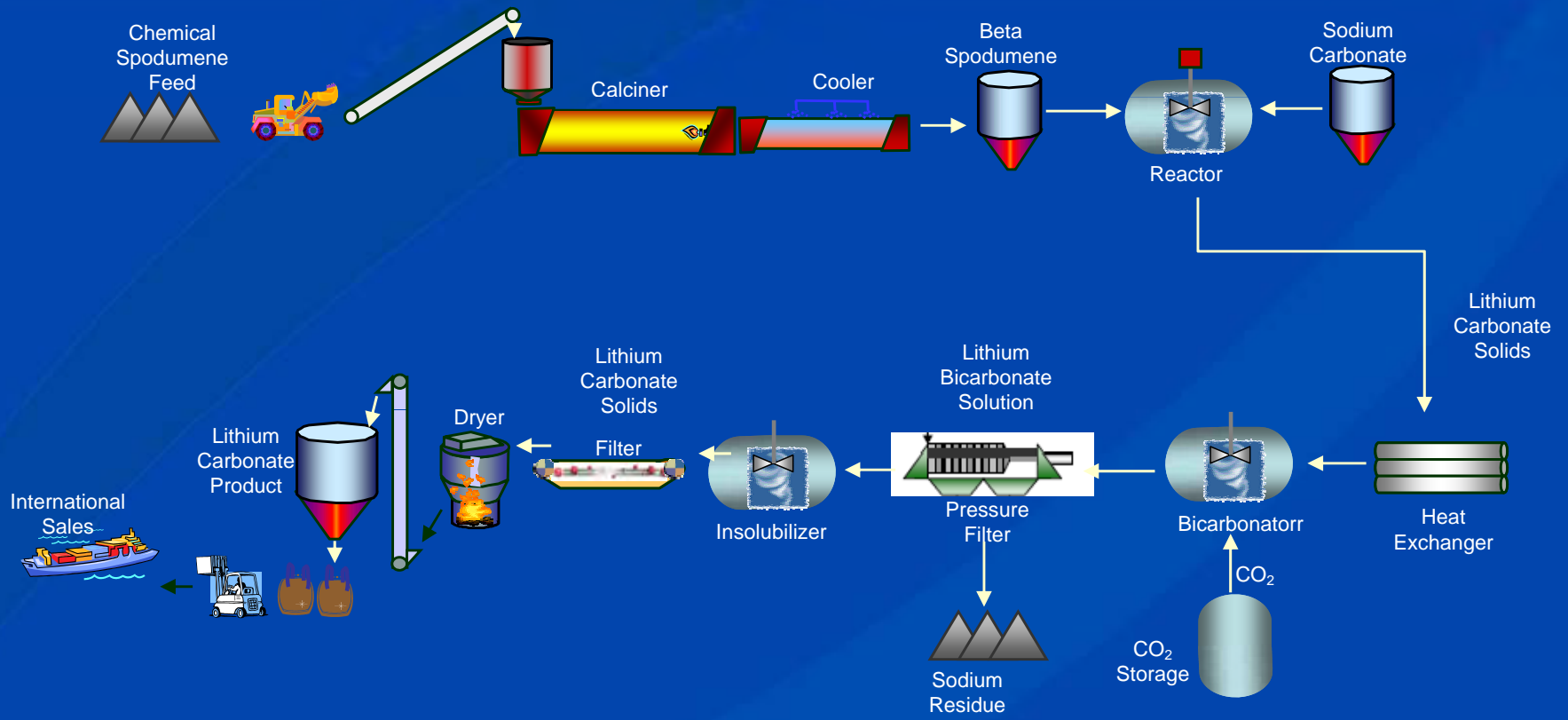
# OUTOTEC RESULTS

- ◆ Outotec Oyj appointed
- ◆ Keliber's  $\text{Li}_2\text{O}_3$  process in Finland
- ◆ Potential - battery grade  $\text{Li}_2\text{O}_3$
- ◆ Via 'Soda Ash' processing technique
- ◆ Sulphuric Acid & Soda Ash both viable
- ◆ Initial leaching recoveries > 90 %
- ◆ Soda Ash chosen as preferred processing route
- ◆ Stringent levels of electrochemical grade  $\text{Li}_2\text{O}_3$
- ◆ Complete scoping work by mid 2009



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# LI CARBONATE FLOW SHEET



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# SHARE PRICE



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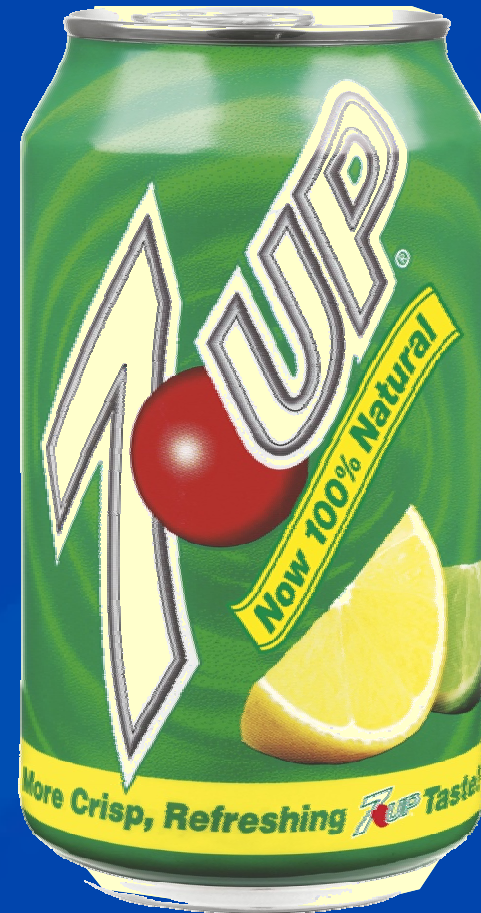
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# ORIGINS OF 7-UP

- ◆ Launched in the 1929 US Great Depression
- ◆ Lithium as one of its main ingredients
- ◆ Bib-Label Lithiated Lemon-Lime
- ◆ Changed to "7-Up"
- ◆ Atomic Weight of lithium is 7
- ◆ Pick-me-up popular drink
- ◆ Re-launch with the financial crisis?



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# MEETING A LITHIUM FUTURE

- ◆ Industrial Mineral Focussed
- ◆ Exciting Potential
- ◆ Meeting a lithium future
- ◆ Lithium Ion Batteries
- ◆ Electric Vehicles
- ◆ Sustained Growth Cycle
- ◆ Early cash flow strategy

