

LITHIUM MARKET OUTLOOK



Foro del Litio

August 2018

Daniel Jimenez

SVP Iodine, Lithium and Industrial Chemicals



Agenda

1 Lithium Market

2 Demand

2.1 Global

2.2 Li-ion Batteries and Electric Vehicles

3 Supply

4 Lithium at SQM

Lithium Market

Background

- Lithium is widely spread in nature⁽¹⁾.
- Lithium is found in:
 - Continental brines (100-2,700 ppm)
 - Dried out “Salares” (e.g. Atacama in Chile, Hombre Muerto in Argentina, Uyuni in Bolivia and Silver Peak in the US).
 - Salt lakes (e.g. Zhabuye and Qinghai in China).
 - Minerals (2,300-18,000 ppm)
 - About 145 mineralogical species, however only a few are commercial sources of Lithium (e.g. spodumene, petalite and lepidolite).
 - Other resources
 - Oil field brines (e.g. Smackover, Texas, USA) (60-500 ppm)
 - Geothermal brines (e.g. Imperial Valley, California, USA) (50-400 ppm)
 - Sedimentary clays (e.g. hectorites in USA y jaderites in Serbia) (2,000-3,000 ppm)
 - Sea water (0.17 ppm)

Brines



Minerals



(1) 20 ppm, similar in abundance as other common elements (Nickel: 84 ppm, Zinc: 70 ppm, Copper: 60 ppm, Cobalt: 25 ppm, Lead: 14 ppm, Tin: 1,3 ppm, Beryllium: 2,8 ppm, Molybdenum: 1,2 ppm).

Lithium Market

World resources

USGS Lithium Reserves 2017	
Country	Reserves (MT)
Argentina	2.000.000
Australia	2.700.000
Brazil	48.000
Chile	7.500.000
China	3.200.000
Portugal	60.000
US	35.000
Zimbawe	23.000
Total (Li)	15.566.000
Total (LCE)	82.811.000

Source: USGS

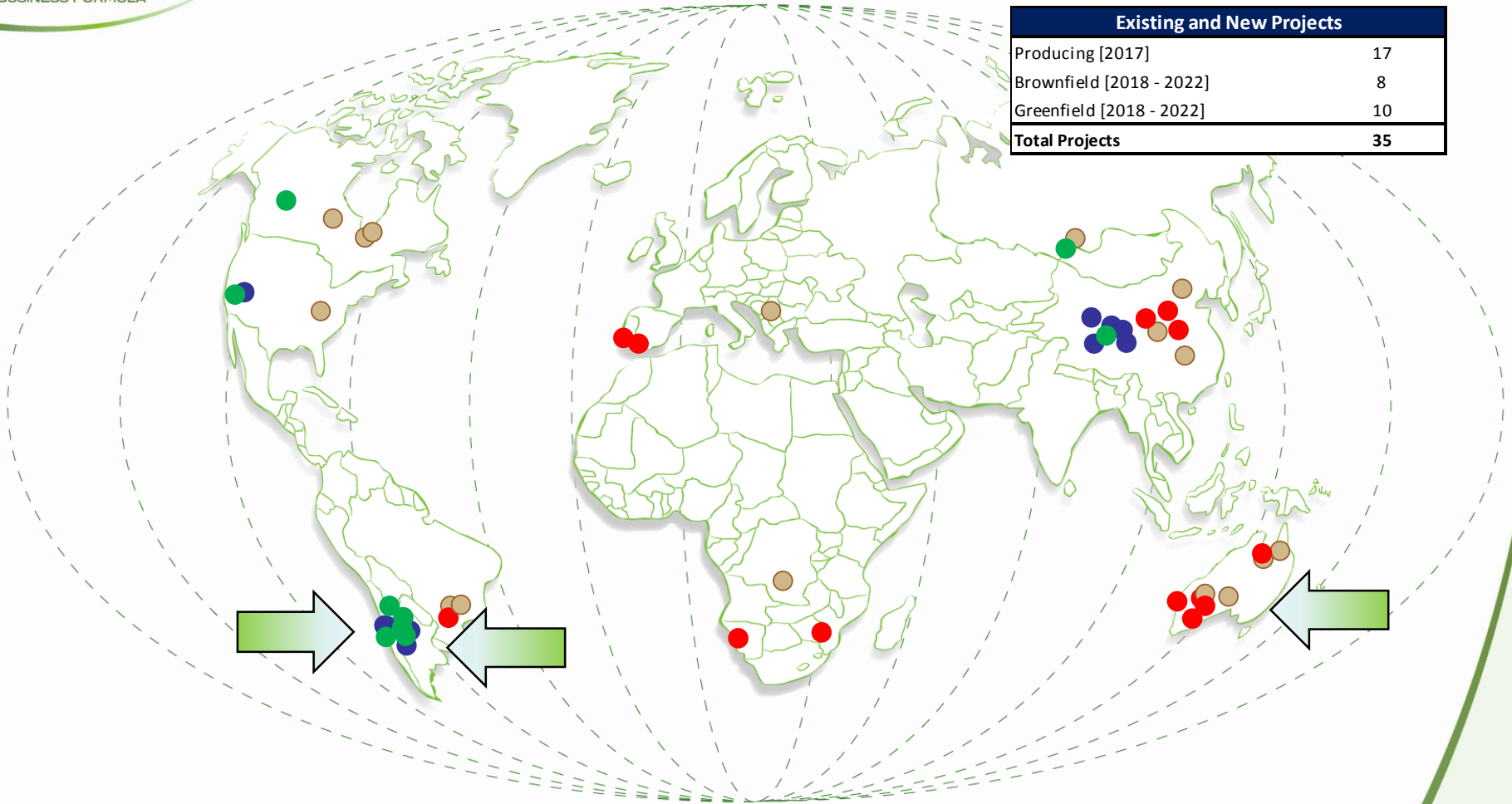
- SQM Reserves (20F Report 18):
8.130.000 MT-Li
→ Enough to supply **200 years** of world's 2017 lithium demand.

Source: SQM

Lithium Market

Global resources

Existing and New Projects	
Producing [2017]	17
Brownfield [2018 - 2022]	8
Greenfield [2018 - 2022]	10
Total Projects	35



● Active Brine

● Potential Brine

● Active Mineral

● Potential Mineral

➔ SQM Projects

Agenda

1 Lithium Market

2 Demand

2.1 Global

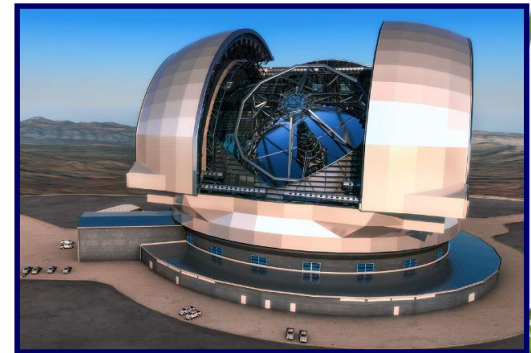
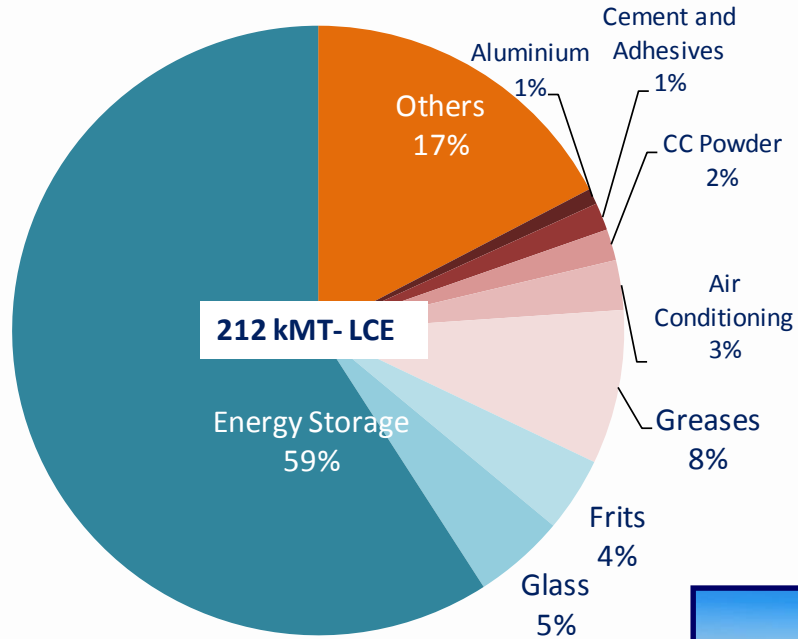
2.2 Li-ion Batteries and Electric Vehicles

3 Supply

4 Lithium at SQM

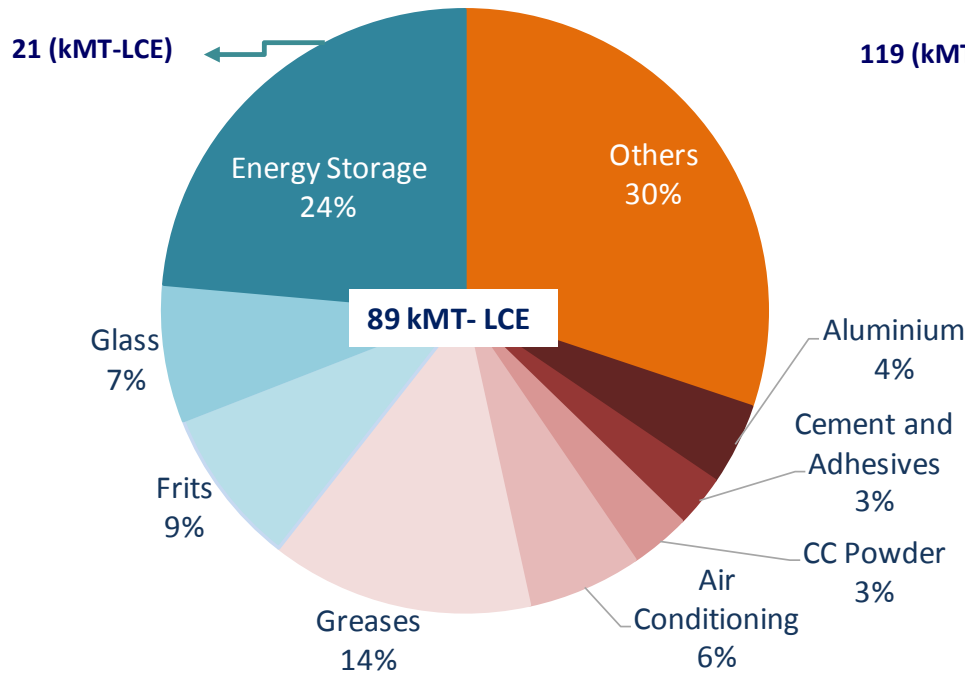


Lithium Chemicals Demand 2017

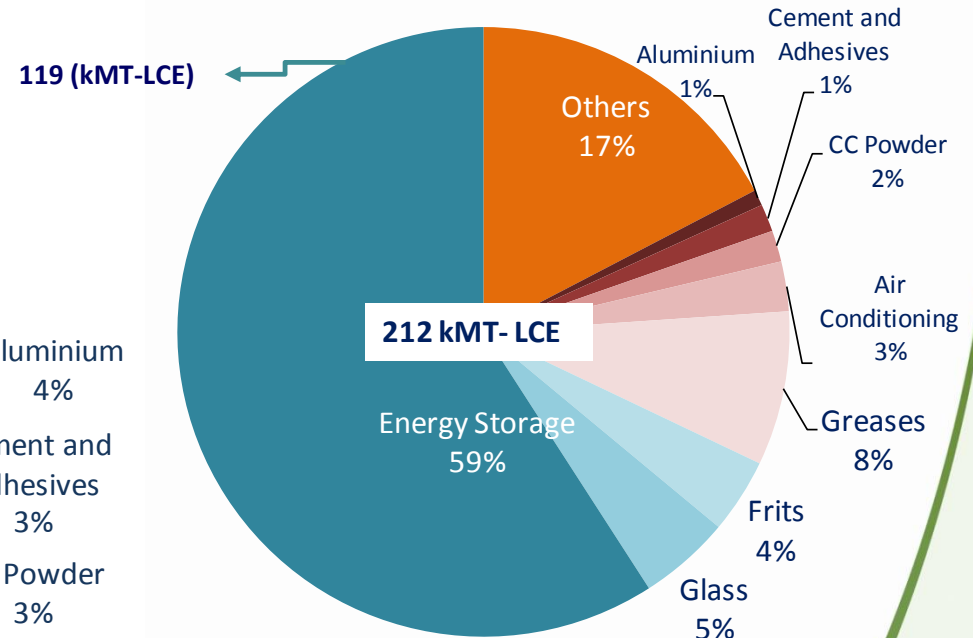


Lithium Chemicals Demand 10-year comparison

2007

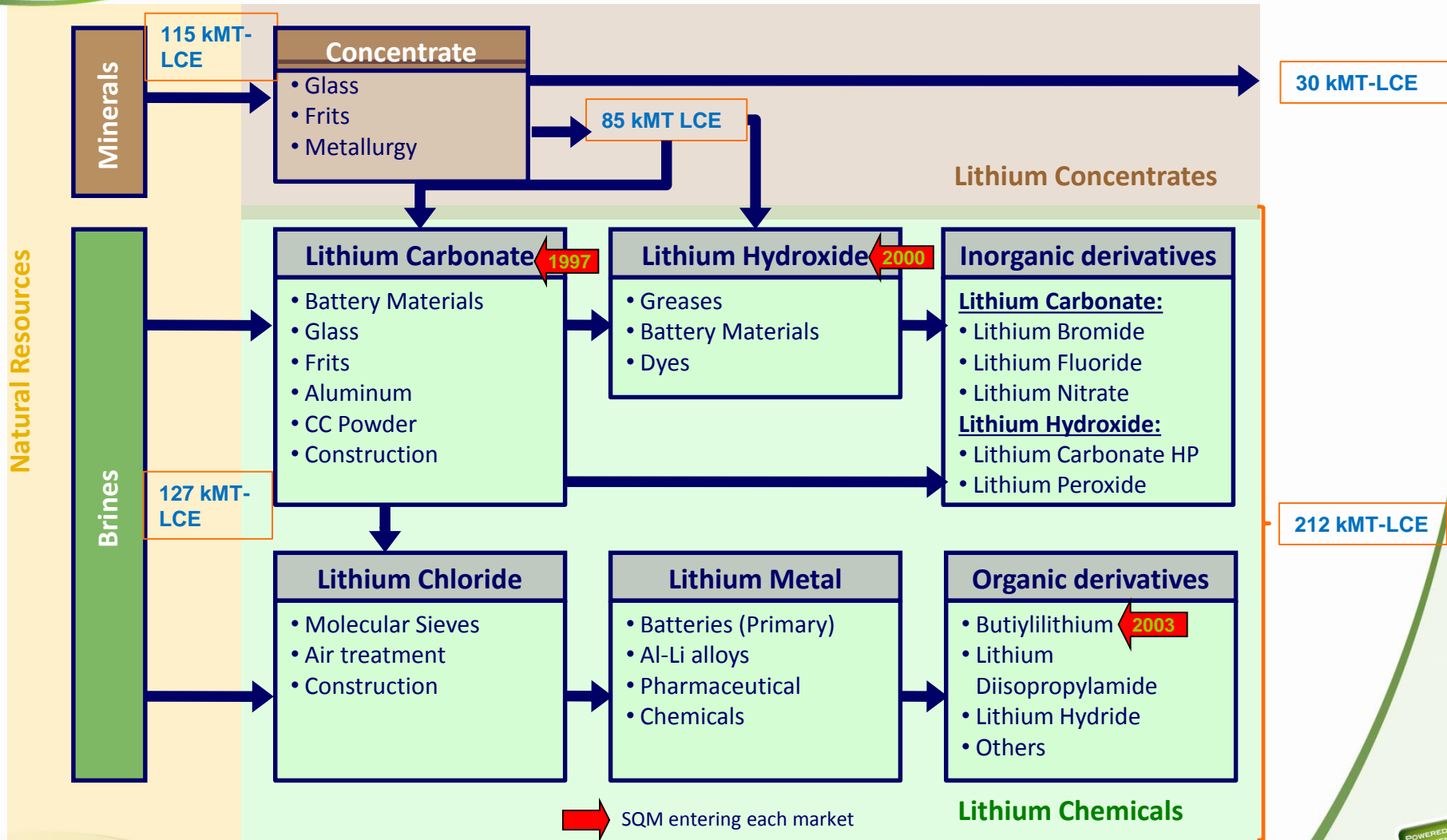


2017

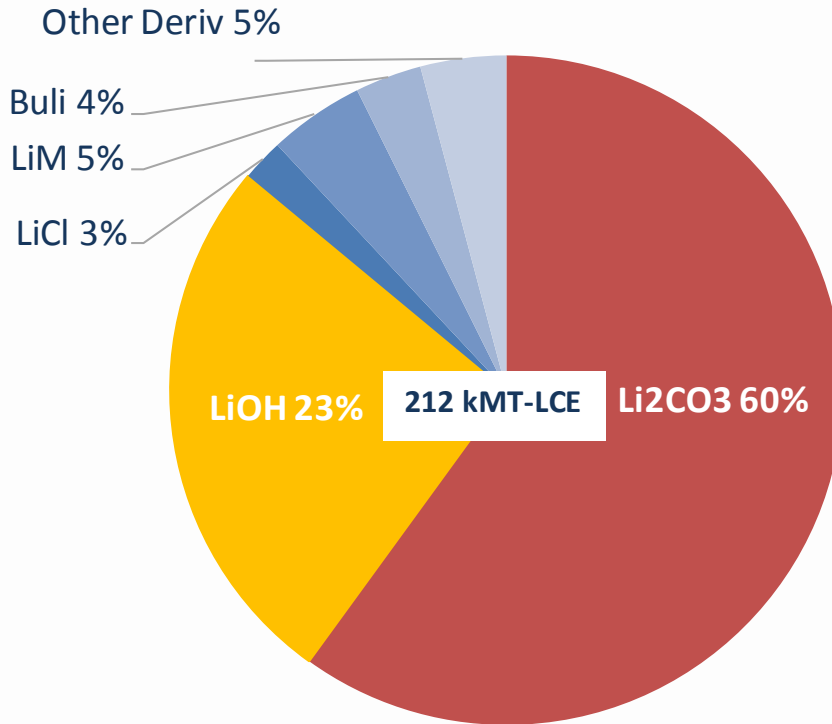


Demand: global

Overview of Lithium production (2017)



Lithium Chemicals 2017 (%)



Li₂CO₃ = Lithium Carbonate

LiOH = Lithium Hydroxide

LiCl = Lithium Chloride

LiM = Lithium Metal

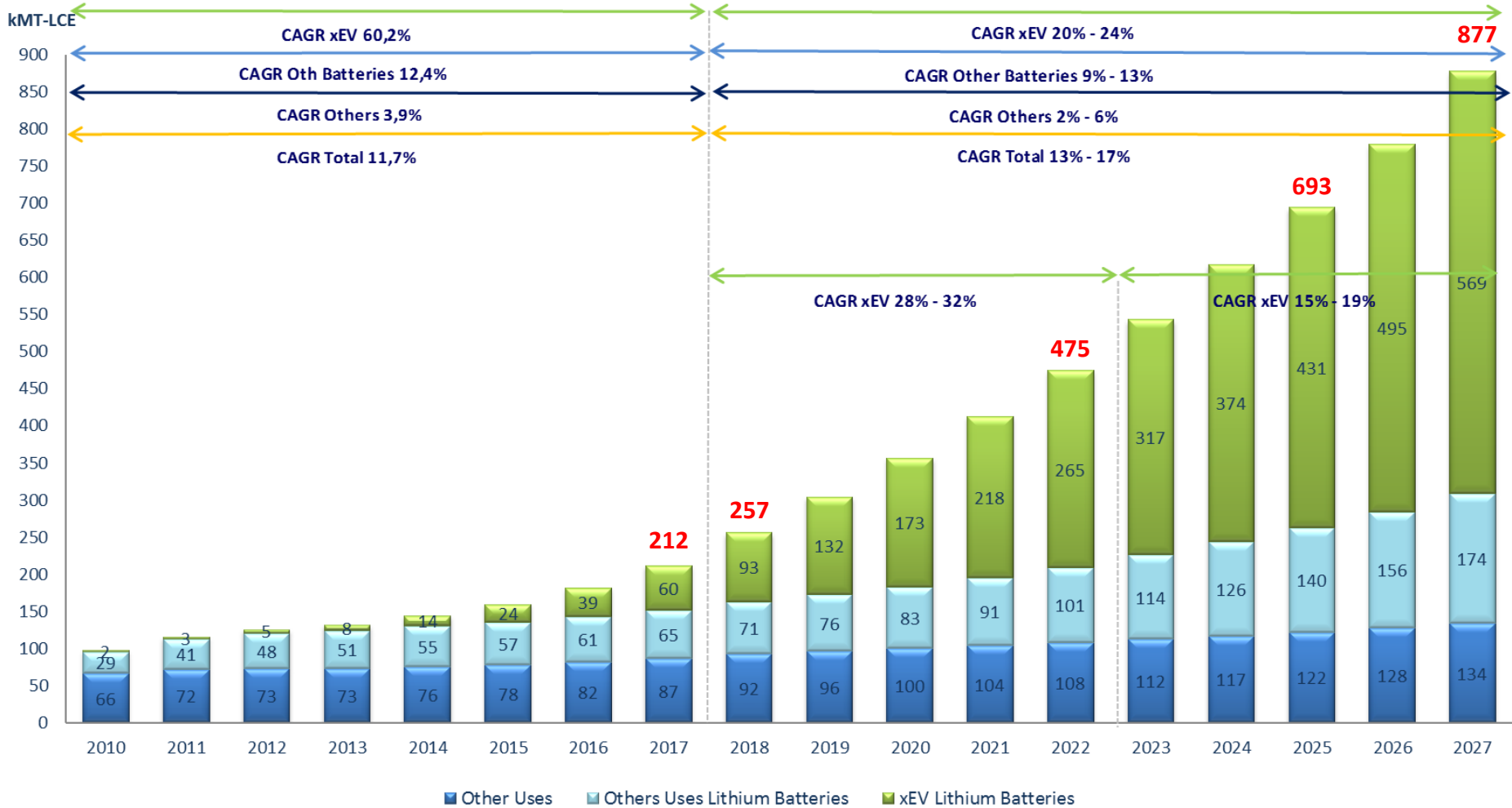
Buli = Butylolithium

Other Deriv = Inorganic and Organic Derivatives



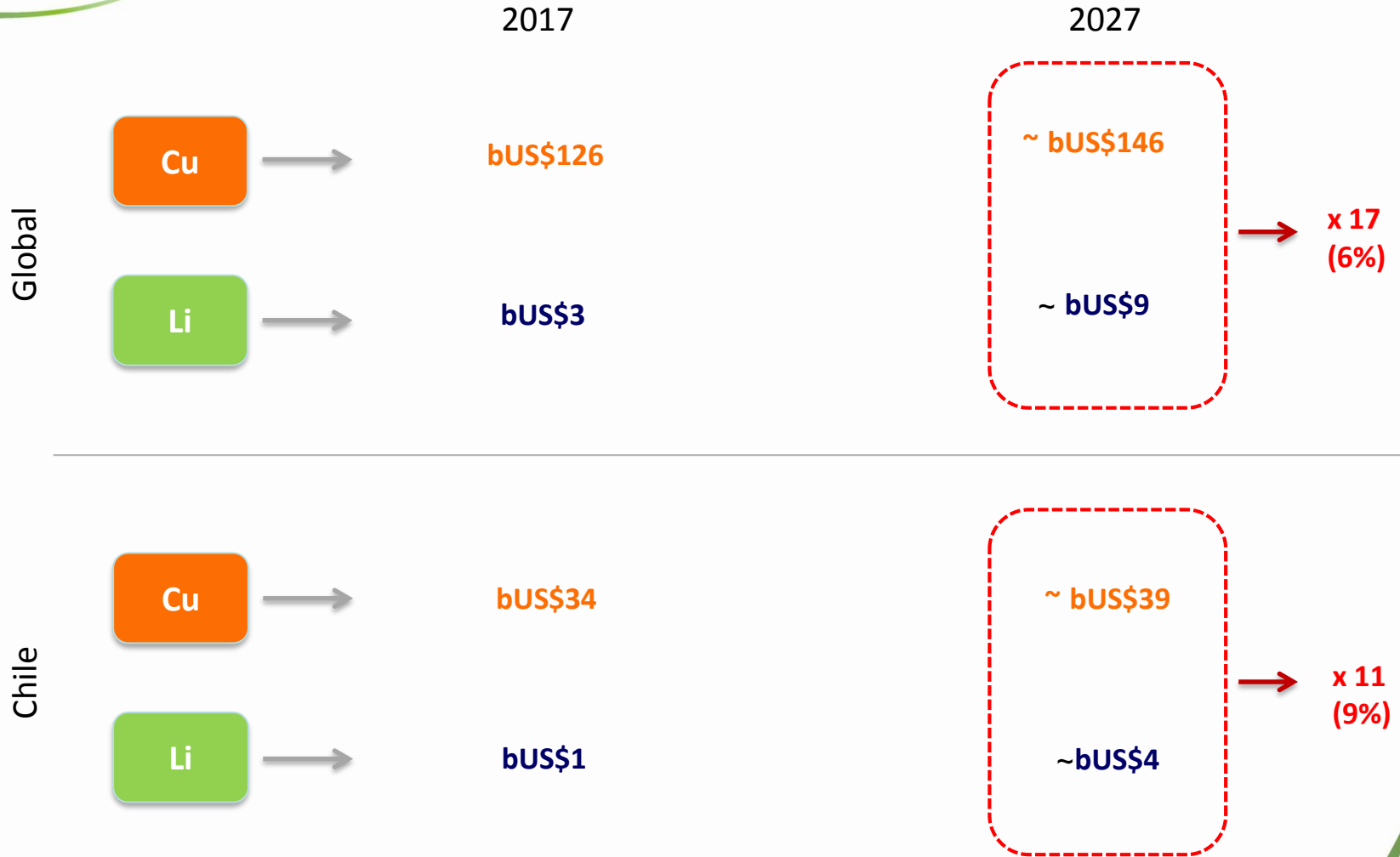
Demand: global Evolution

Required investment: USD 10-12 Billion over the next 10 years.
 Typical greenfield Capex: KUSD/MT-LCE capacity 13-20



Demand: global

Lithium market relative to Copper market



Source: Cochilco, SQM

Note: Assuming a US\$2.8/lb as long-term Cu price

Agenda

1 Lithium Market

2 Demand

2.1 Global

2.2 Li-ion Batteries and Electric Vehicles

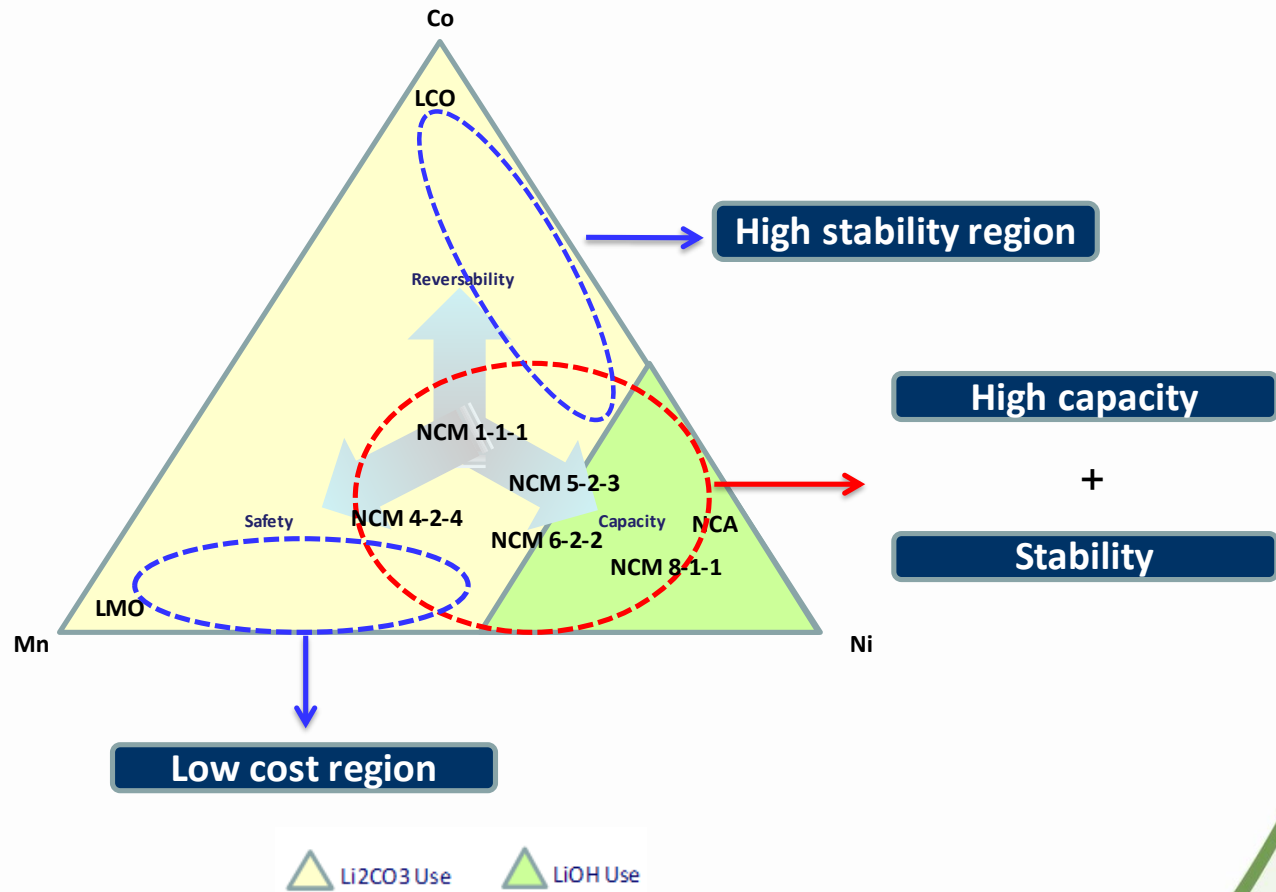
3 Supply

4 Lithium at SQM

Higher Nickel content →
More Lithium Hydroxide use

NCM cathodes: Lithium (Li) mixed with Nickel (Ni), Cobalt (Co) and Manganese (Mn)

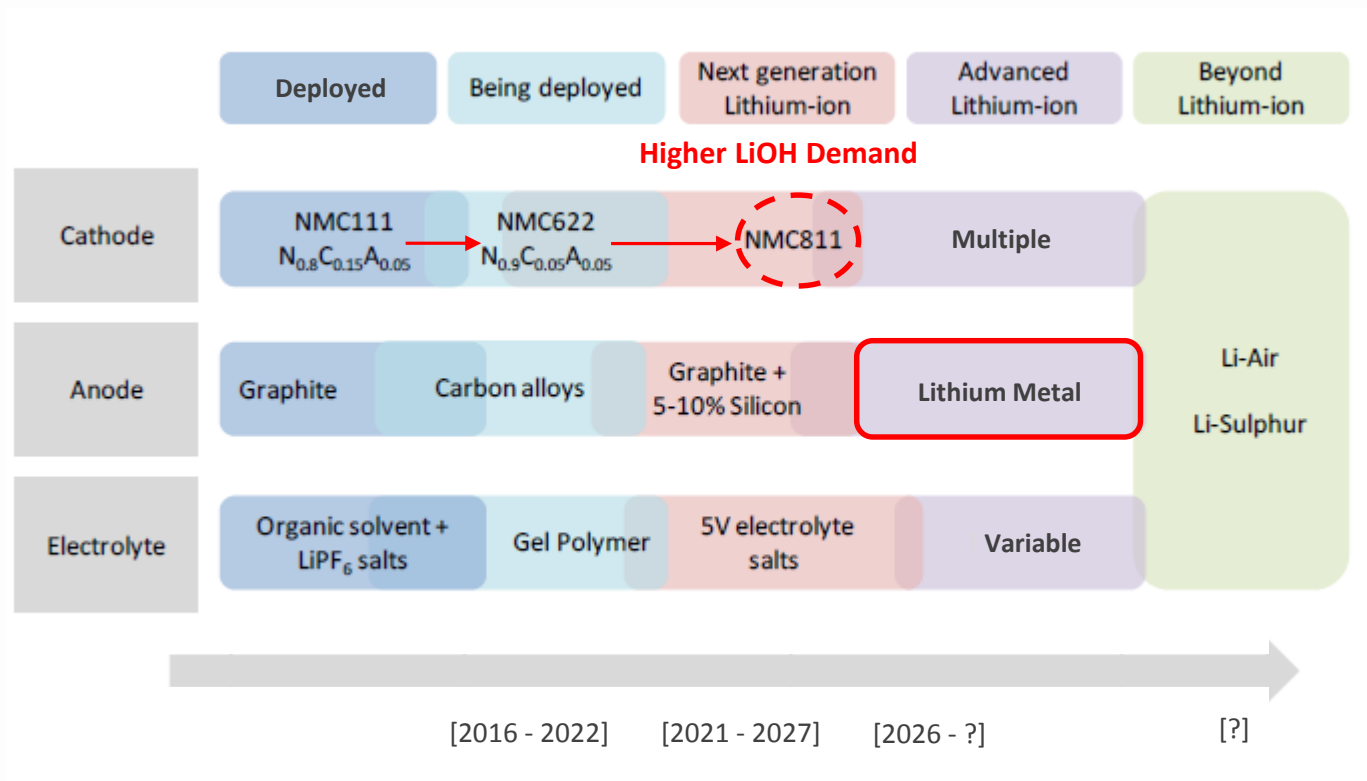
OEM target: higher energy density (High Ni) and lower cost (Low Co)



Demand: Li-ion Batteries

Expected battery technology commercialization timeline

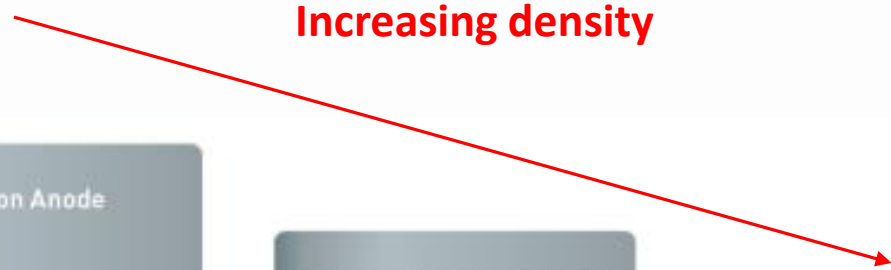
Higher Lithium Hydroxide demand compared to Lithium Carbonate



Demand: Li-ion Batteries

Li-ion vs Lithium Metal

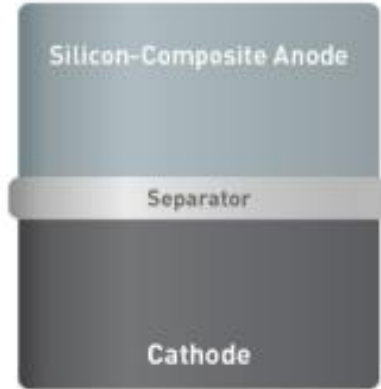
Trend: higher energy density



Liquid Electrolyte



**Gen 1
Li-ion**
200-250 Wh/kg
600 Wh/L



**Gen 2
Li-ion**
250-300 Wh/kg
700 Wh/L



**Gen 3
Li-Metal**
400-500 Wh/kg
1200 Wh/L

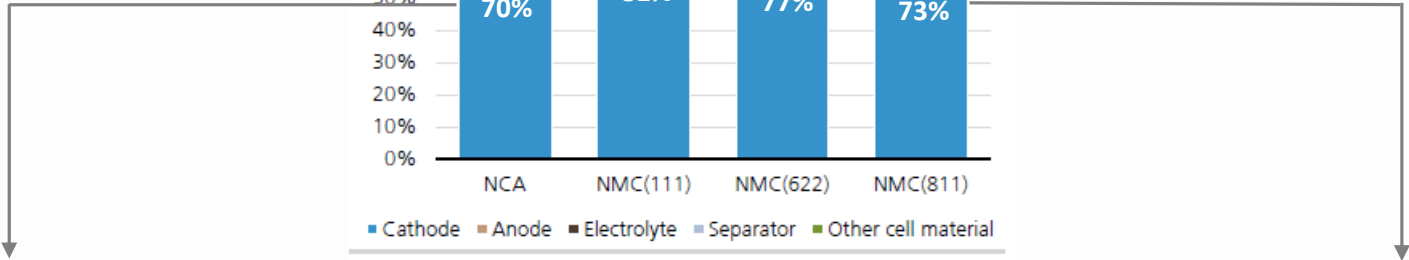
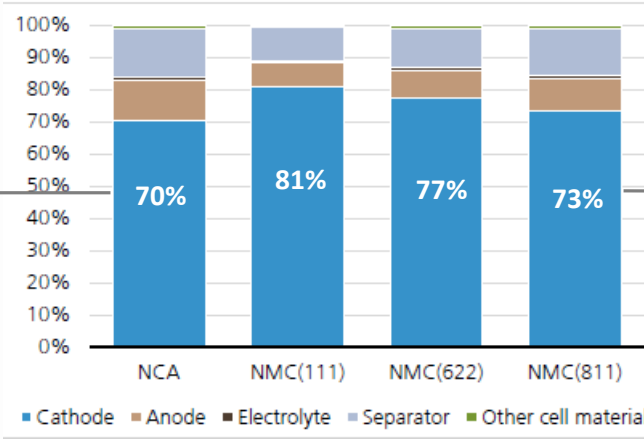
Solid Electrolyte

Demand: Li-ion Batteries

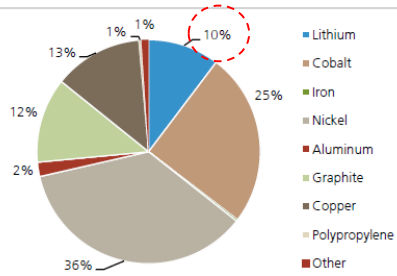
Li-ion battery cost breakdown

Lithium cost is ~ 7% of Li-ion battery materials

Active material cost (% of total bill of mat's)

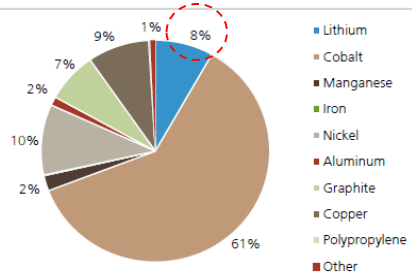


Total active material bill of materials (NCA)



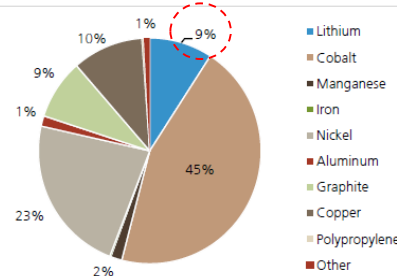
7% of cost

Total active material bill of materials (NMC111)



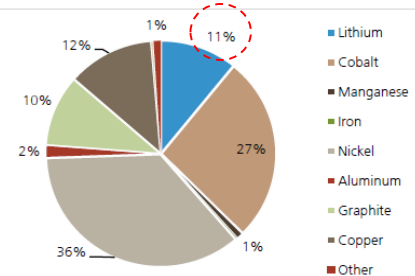
6% of cost

Total active material bill of materials (NMC622)



7% of cost

Total active material bill of mat's (NMC811)



8% of cost

Source: UBS

LIB cost does not include depreciation not labor (only materials)

Demand: Electric Vehicles

Lithium content today

Lithium content in each device, kg-LCE (Lithium Carbonate Equivalent)



Demand: Electric Vehicles

Best selling Battery Electric Vehicles (BEV)

**Performance:
6-8 Km/kWh**

Renault Zoe



EU Q1-18 Sales: 8,947 units
Range: 241 Km
Battery Pack: 41 kWh
Li used: 31 Kg LCE
MSRP: US\$ 23,000

Tesla Model 3*



US Q1-18 Sales: 8,180 units
Range: 354 Km
Battery Pack: 50 kWh
Li used: 38 Kg LCE
MSRP: US\$ 35,000

BAIC EC-SERIES **



China Q1-18 Sales: 19,808 units
Range: 156 Km
Battery Pack: 20 kWh
Li used: 15 Kg LCE
MSRP: US\$ 24,000

Performance between 6-8 Km/kWh

Several sources

*Base Model

** Features for BAIC EC-180 EV

Demand: Electric Vehicles

OEMs announcements

Car manufacturers committed to Electric Vehicles

Region	OEM	Year	Investment	Announcements
				xEV Target
NAFTA	Ford	2022	\$11 billion	40 xEV including 16 BEV
	GM	2022		>20 BEV
	Tesla	2024		Sales of Model 3 around 274 kunits
EMEA	BMW	2025	€ 12 billion	xEVs to account for 15-25% of sales
	Daimler	2025		25 electrified models (12 BEV)
				xEVs for 15-25% of sales
	Volvo	2025		>10 BEV models
				40 hybrid models
50% of sales to be electric				
VW	2025	Over € 20 billion	80 xEV models	
	2030	\$40 billion	Electrified versions of all +300 global models	
ASIA	Honda	2030		2/3 of total car sales to be electrified
	Toyota	2020		Launching 10 EVs
		2030		Selling 5.5 million electrified vehicles (including hybrids and hydrogen fuel cells)
	Nissan	2022		8 new EV models
	Dongfeng	2022		Sales of 1 million units
				xEV sales accounting for 30% of total sales
	BYD	2020		Sales of 600 kunits
BAIC	2020	Production of 800 kunits		

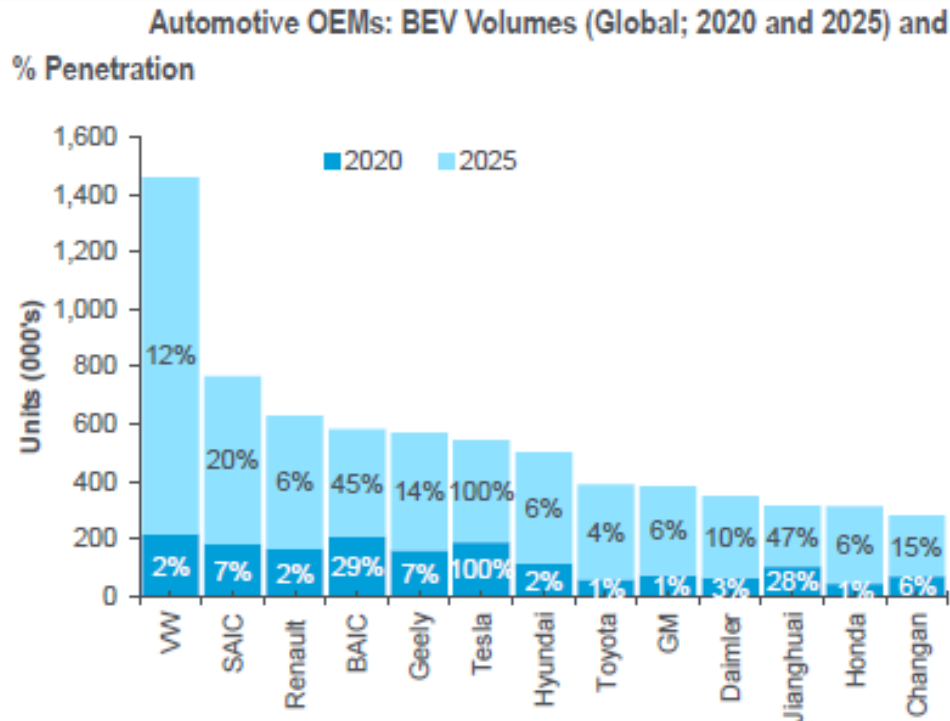


Demand: Electric Vehicles

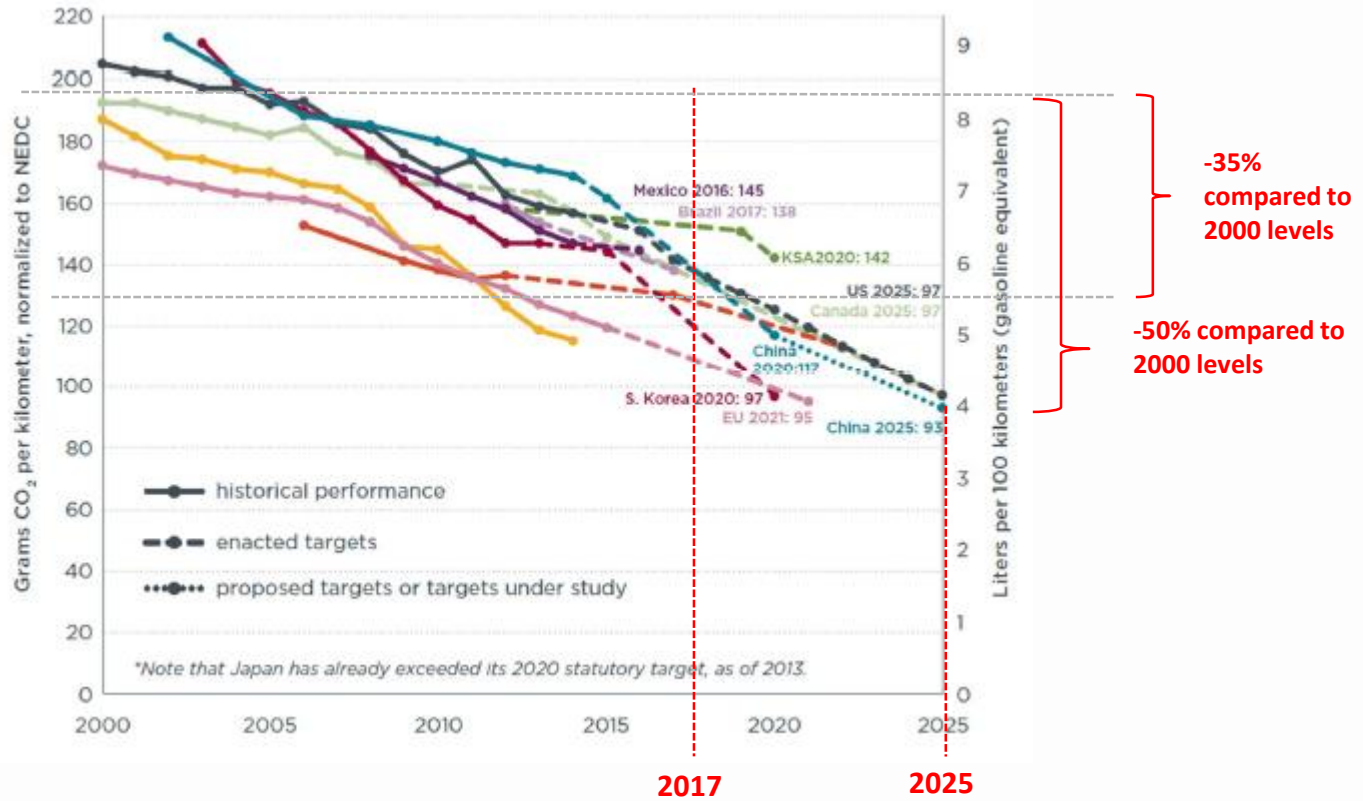
Penetration by OEM 2020 and 2025

Car manufacturers committed to Electric Vehicles

Most dramatic change in sales during 2020-2025



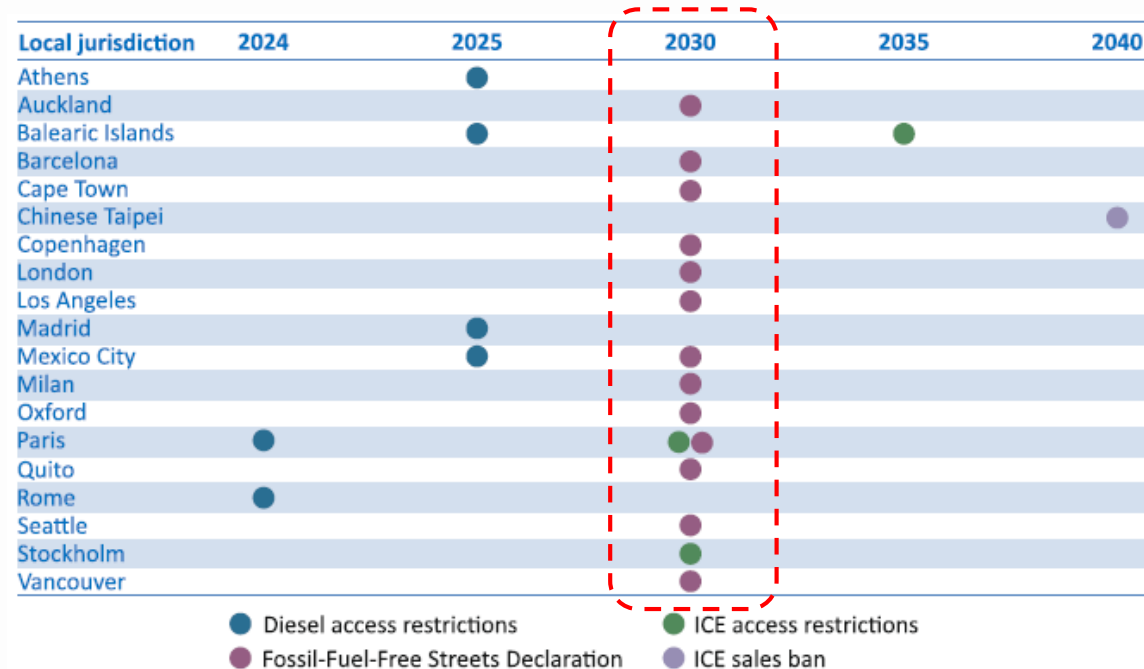
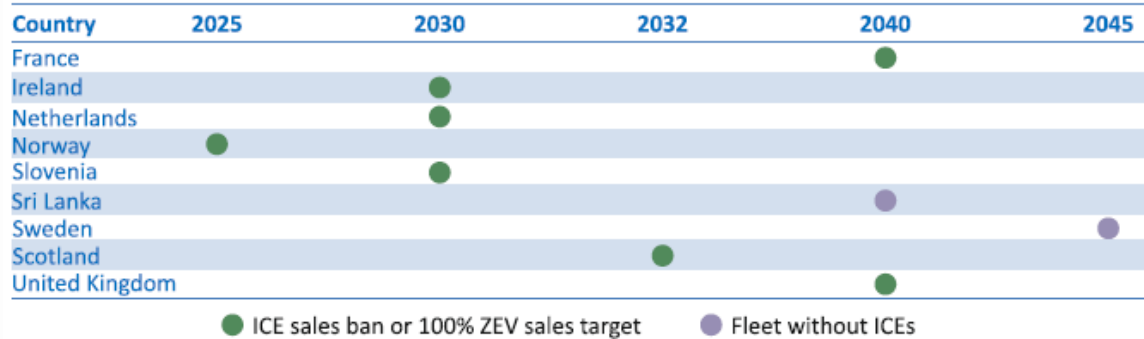
More stringent government regulations



Demand: Electric Vehicles

ICE announced sales bans and access restrictions

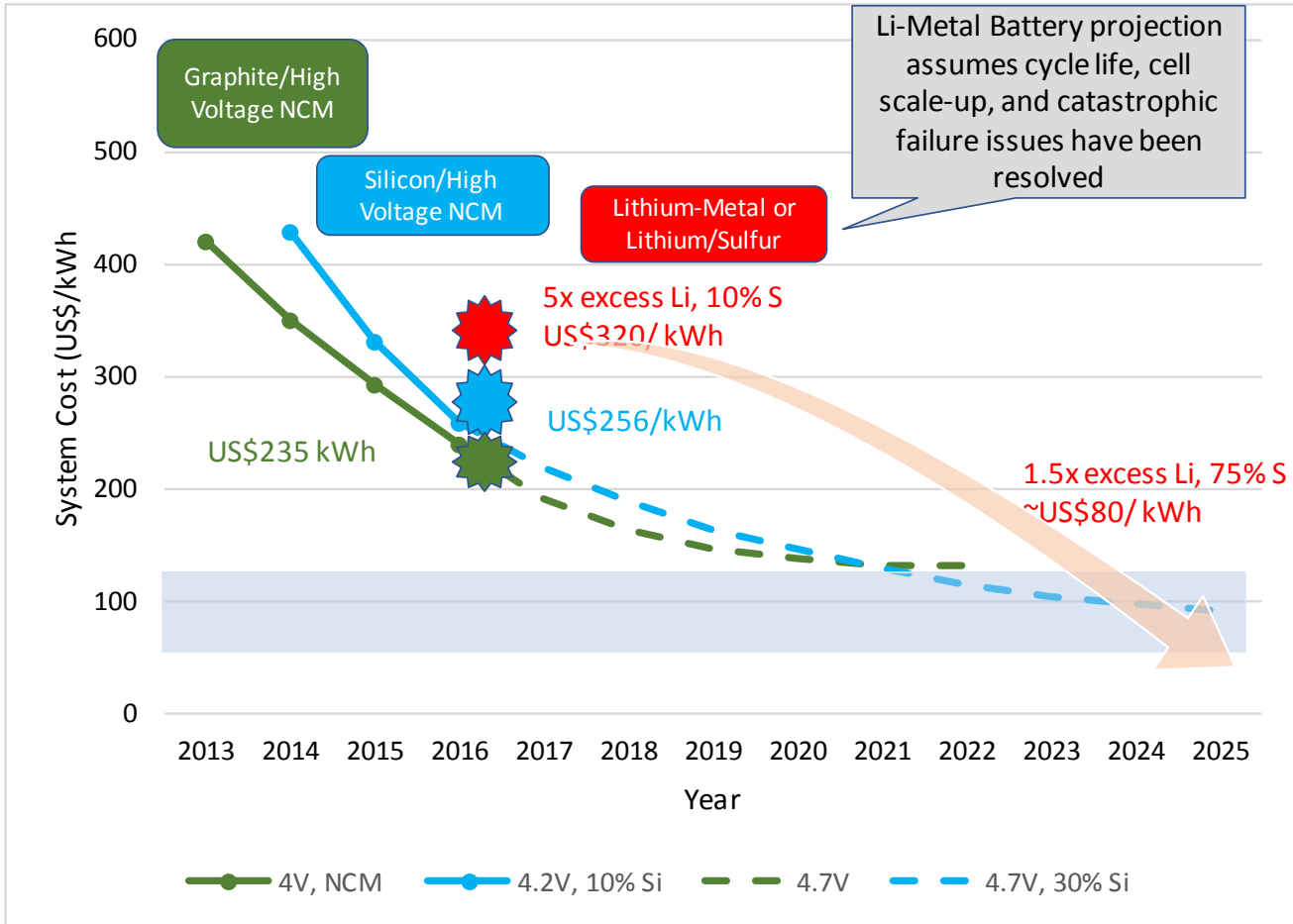
Internal Combustion Engines (ICE) bans



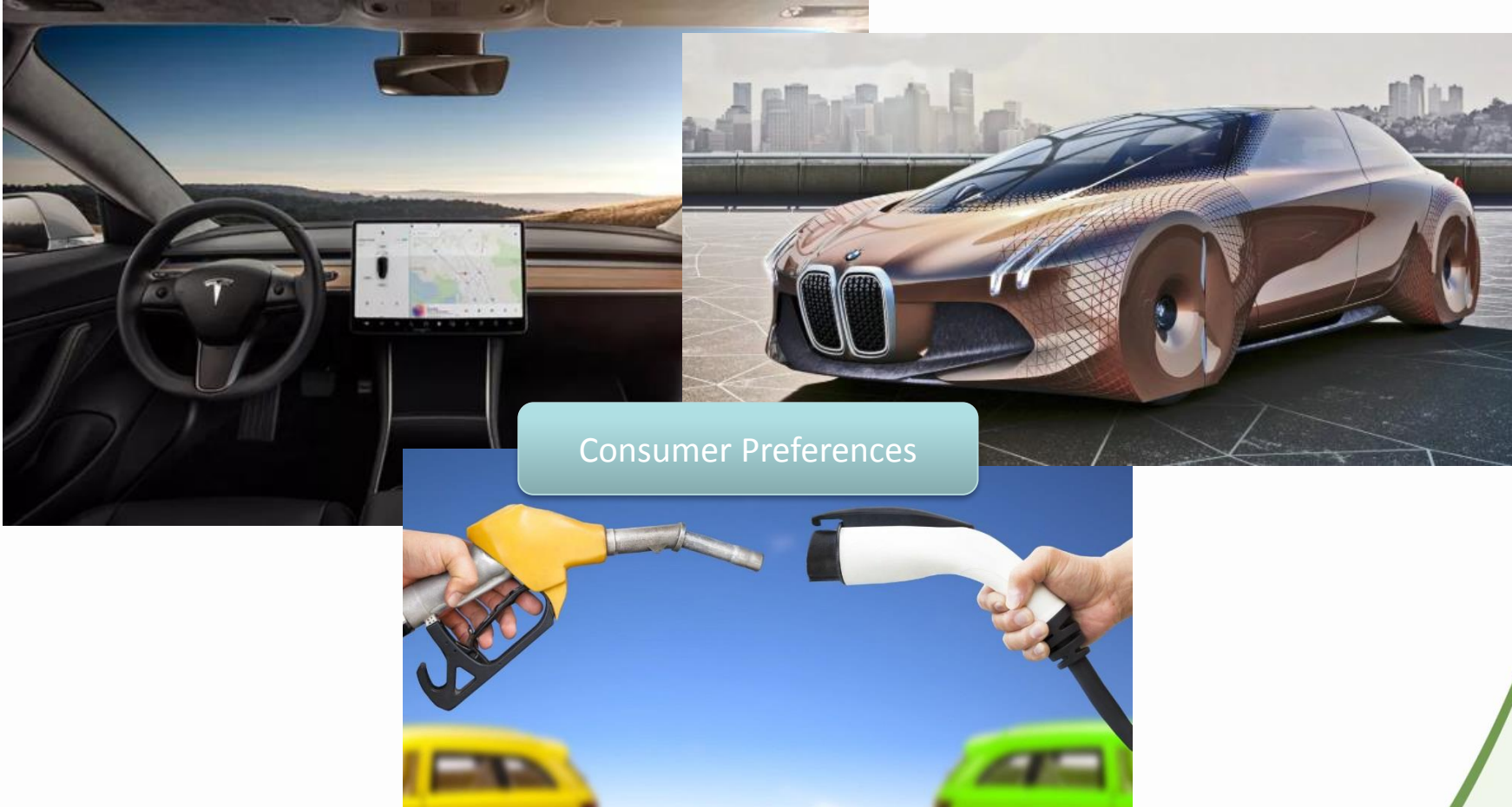
Demand: Electric Vehicles

Lithium-ion battery cost forecast

**Li-ion battery cost today:
barrier for adoption**



The decision of buying an electric is not only economics



Consumer Preferences

Agenda

1 Lithium Market

2 Demand

2.1 Global

2.2 Li-ion Batteries and Electric Vehicles

3 Supply

4 Lithium at SQM

Supply

Capacity by player and country 2017 - 2022

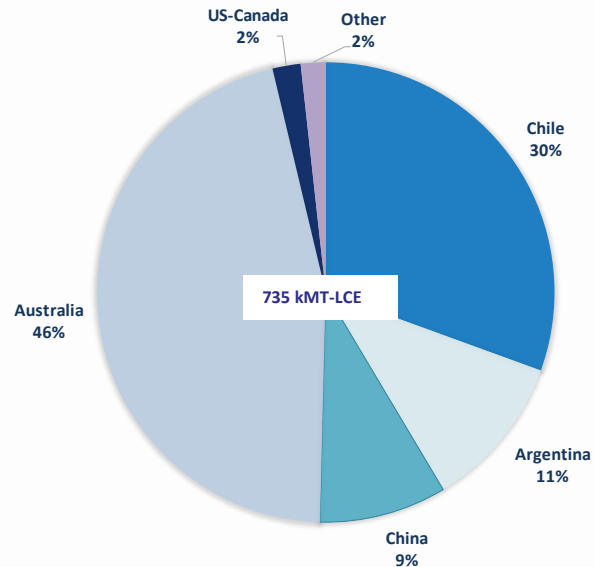
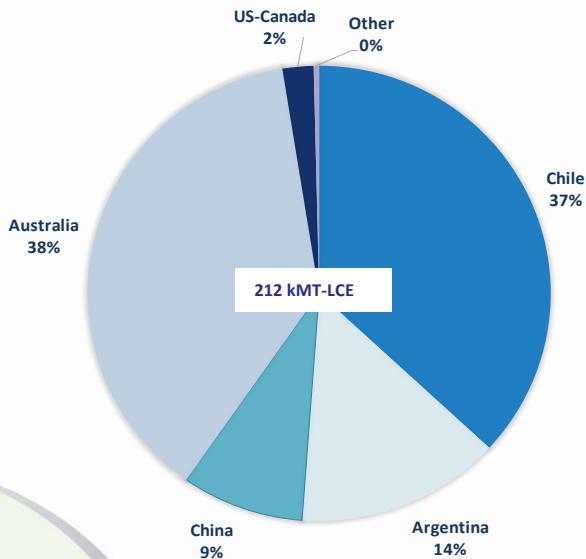
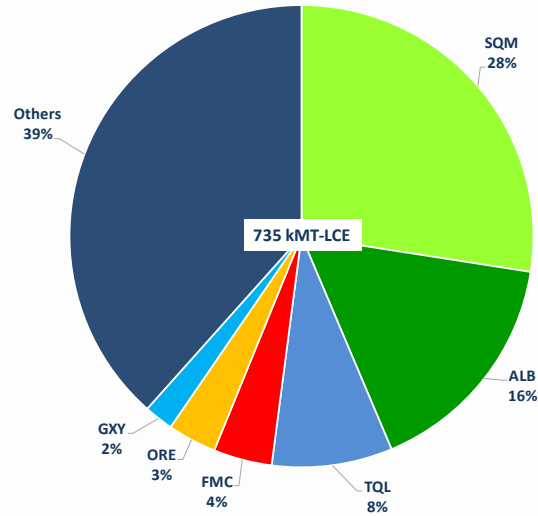
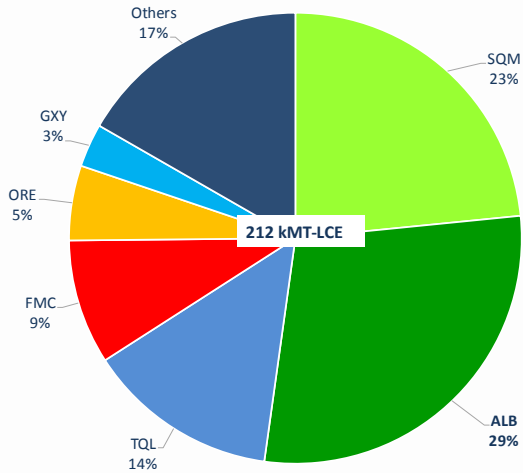
Australia 2022: 46%

Lithium Chemicals Supply and Announced Capacity

Note: Raw material for direct use not included.

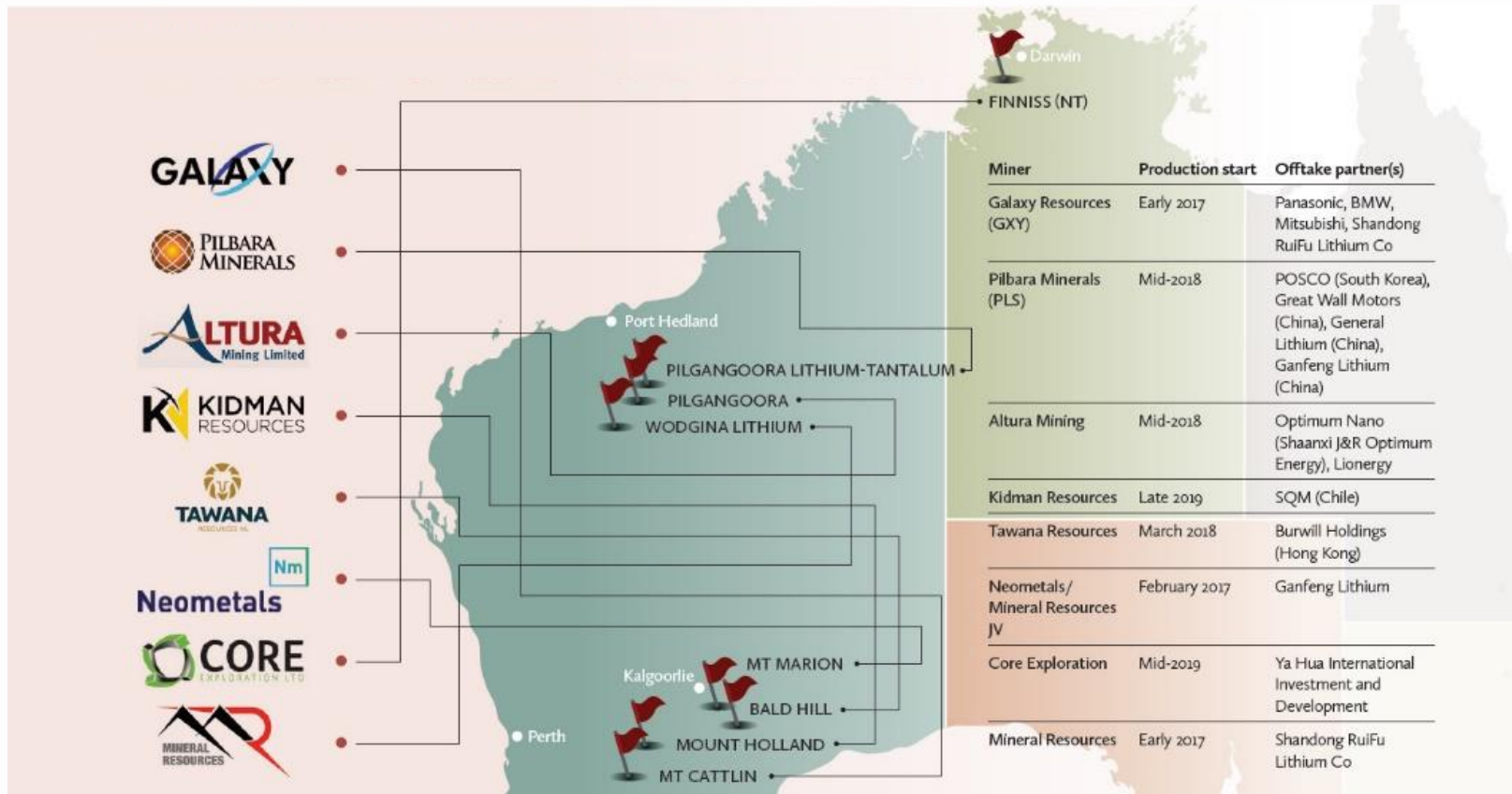
2017

2022F



Supply

Competitors Australia



Agenda

1 Lithium Market

2 Demand

2.1 Global

2.2 Li-ion Batteries and Electric Vehicles

3 Supply

4 Lithium at SQM

Lithium at SQM

Immediate Lithium capacity - Chile

Lithium Carbonate

- Current capacity: 48 kMT/year
- Expansion to 70 kMT/year (end 2018)
- Expansion to 120 kMT/year (end 2019)
- Expansion to 180 kMT/year (end 2021)

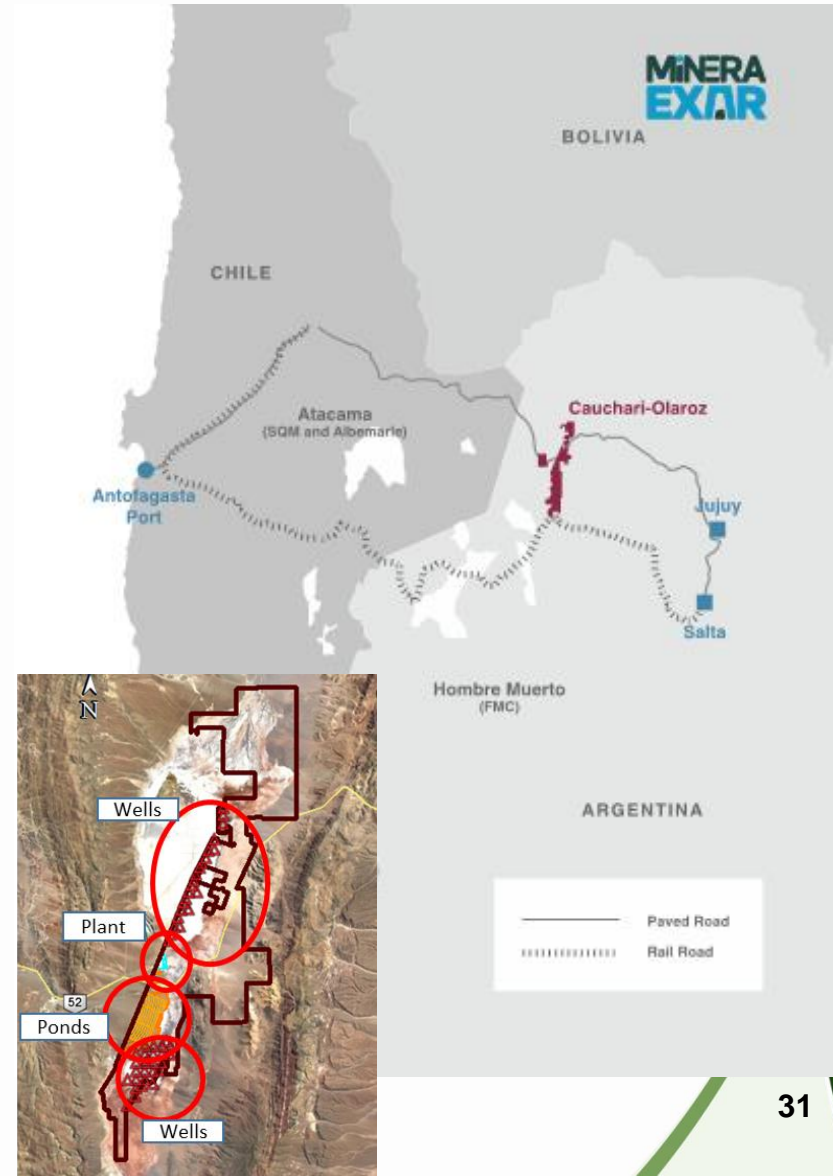
Lithium Hydroxide

- Current capacity 6,000 MT/year
- Expansion to 13,500 MT/year (end 2018)



Project description:

- Salar de Cauchari-Olaroz
- JV 50/50 with Lithium Americas Corp.
- Resource: brine
- Similar technology as in Salar de Atacama
- Capacity: 25 KMT-LCE/year (Li_2CO_3)
- Startup: 2020



Lithium at SQM

Lithium projects - Australia

Project description:

- Mt. Holland
- JV 50/50 with Kidman Resources
- Resource: spodumene
- Capacity: 40 KMT-LCE/year (Li₂CO₃/LiOH)
- Startup:
 - Spodumene concentrate: 2020
 - Li₂CO₃/LiOH: 2021



Continuous quality improvement

Lithium Carbonate

- Chemical:
 - Higher purity
 - Customized contaminants profile
 - Magnetic metallic particles
- Physical:
 - Micronization: Customized particle size distribution

Lithium Hydroxide

- Chemical:
 - Higher purity
 - Customized contaminants profile
 - Magnetic metallic particles
- Physical:
 - Micronization: customized particle size distribution
 - Caking
- Process Development:
 - Brine to Lithium Hydroxide

Lithium Metal

- Chemical:
 - TBD
- Process Development:
 - Efficiency
 - Low cost

Lithium is abundant and well spread geographically

Lithium demand growing at high rates: CAGR 15% (2017-2027)

Main driver: energy storage (particularly Electric Vehicles)

- OEM commitment + Environmental regulations + Consumer preferences + Mass production / Cost reduction

Lithium-ion battery the predominant technology for Electric Vehicles (10-15 years)

- High Nickel Lithium-ion: Lithium Carbonate / Lithium Hydroxide

New battery technologies will continue requiring lithium

- Solid-State: Lithium Metal

Lithium represents a small portion of Li-ion battery total cost

Many new lithium projects, Australia to become the leading Lithium producer

SQM to take back the # 1 global lithium producer:

- Technical know-how and deep commercial knowledge
- Diversified resource base
- Ready to face the future industry challenges (e.g. quality, product)



Thank You...

