



COLLERINA  
Cobalt Limited



**MINING THE METALS OF THE FUTURE**

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# Collerina Cobalt Limited (ASX : CLL)



**Collerina Cobalt ('CLL') is an ASX-listed high purity alumina (HPA)-nickel-cobalt company focused on advancing its 100% owned Collerina Project in central NSW.**

**CLL's vision is to combine its management's experience in exploration and project development with proprietary processing technologies to produce technology metals of the future.**

# Investment Highlights



- **A unique HPA-nickel-cobalt project favourably located in one of Australia's most prolific mining jurisdictions**
  - Proximal to CleanTeq's Sunrise and Australian Mines' Flemington projects
- **Proprietary processing technology capable of delivering strong economics**
  - Licensed processes to deliver several high value revenue streams/co-product credits
- **Multiple high-value products with strong demand fundamentals that are at the forefront of the world's technology revolution**
  - CLL's intended HPA and nickel/cobalt products are the feedstock for the devices, applications and vehicles of the future
- **Project economics befitting a junior miner**
  - Anticipated modest capex, high margins, rapid payback
- **Highly experienced Board and management team with a track record in exploration success and project development**
  - Seasoned judgement and prudent financial management to underpin project advancement

# Corporate snapshot



## Trading Information

<b>ASX Code</b>	<b>CLL</b>
Share Price (29-Nov-17)	14.0c
52 trading low/high	1.7c-14.0c
Issued shares	487.2M
Unlisted options (@2c)	10.0M (expiry 24 October 2018)
Unlisted options (@10c)	4.0M (expiry 31 October 2019)
<b>Market Capitalisation</b>	<b>\$68.2M</b>
Cash (29-Nov-17)	\$2.3M*
<b>Enterprise Value</b>	<b>\$65.9M</b>
<b>Substantial Shareholders</b>	<b>%</b>
PT Archi Indonesia	22.69
Permgold Pty Ltd (N Seckold)^	10.69
Budworth Capital Pty Ltd	7.19
BT Portfolio Service Limited	6.52
<b>Top 20 Shareholders</b>	<b>71.93</b>

\*An additional ~\$1m has been committed in Tranche 2 of the recent share placement that will be subject to shareholder approval on 18 December 2017 including \$500k from Permgold Pty Ltd.

^ Permgold Pty Ltd will increase to ~12.1% after issuance of Tranche 2 shares.

Share Price Performance (November 2016 - November 2017)



## Recent Highlights

- Nov-17 Successful Solvent Extraction of Ni, Co, and Mn
- Nov -17 4N (99.99%) Purity Achieved in HPA Test Work Program
- Nov-17 Successful Production of High Purity Alumina (HPA) sample
- Nov-17 \$3.5M raised in Share Placement
- Oct-17 Outstanding Aluminium Solvent Extraction Test Work Results

# Board and management



## **Norman Seckold - Chairman**

30+ years in the full time management of natural resource companies.  
Past Chairman and Director of listed companies including Bolnisi Gold NL, Timberline Minerals Inc., Perseverance Corporation Limited, Valdora Minerals NL, Palmarejo Silver & Gold and Cockatoo Coal Limited. Currently Chairman of Santana Minerals Limited and Planet Gas Limited and unlisted public company Nickel Mines Limited.

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## **Justin Werner - Managing Director**

20+ years' mining experience as a resource company consultant and developer.  
Founding partner of PT Gemala Borneo Utama (BUDUK Gold Project and Romang Island Project).  
Romang Island was successfully sold to Robust Resources Limited.  
Currently Managing Director of unlisted public company Nickel Mines Limited.

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## **Peter Nightingale - Director and CFO**

20+ years as a Director or Company Secretary for a range of resource companies including Pangea Resources Limited, Timberline Minerals Inc., Perseverance Corporation Limited, Valdora Minerals NL, Mogul Mining NL, Bolnisi Gold NL, Cockatoo Coal Limited and Sumatra Copper & Gold plc. Currently a Director Planet Gas Limited, Argent Minerals Limited, and unlisted public companies Nickel Mines Limited and Prospech Limited.

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## **Rimantas Kairaitis - Technical Director**

20+ years experience in minerals exploration and resource development in gold, base metals and industrial minerals.  
Led the geological field teams to the discovery of the Tomingley and McPhillamy gold deposits in NSW and steered the Hera gold-lead-zinc Project from discovery through to successful commissioning and commercial production.  
Previously founding Managing Director and CEO of ASX-listed Aurelia Metals.

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## **Tony Sgro - Non-Executive Director**

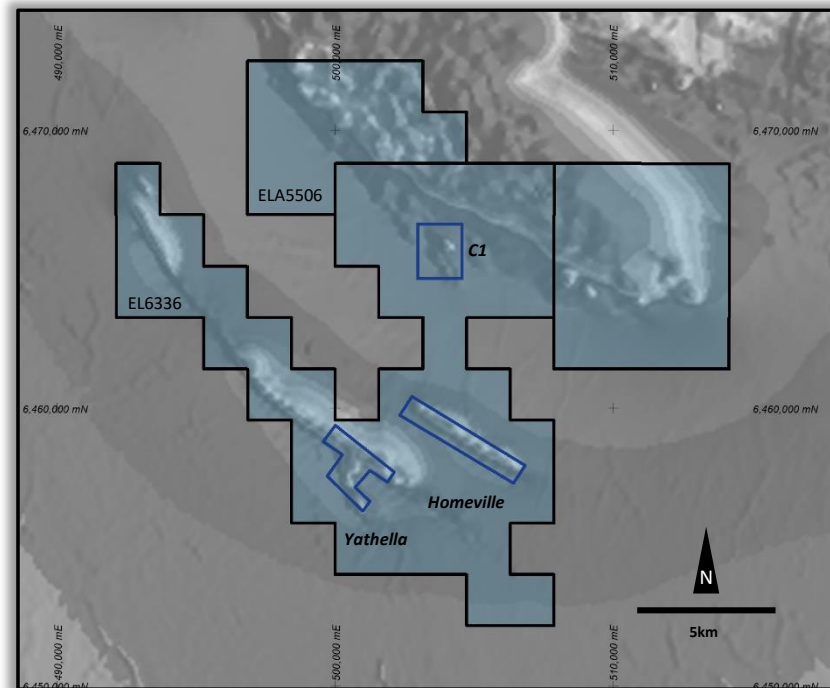
Chemical Engineer with 45+ years' senior management experience in the supply of specialised equipment to the process industries with an emphasis on mining and oil & gas.  
Co-founder, Director and General Manager of Kelair Pumps for 36 years.



# Collerina Project – NSW, Australia



- The Collerina Project area (EL 6336 & ELA 5506) covers ~224km<sup>2</sup>
- Drilling has defined discrete zones of **high grade Co up to 0.70% Co over 4m including 1.02% Co over 2m**
- Mineralisation lies between surface and ~60m. **Deposit remains open at depth and along strike**
- **Unique serpentinite geology** provides the amenability to low Capex, Counter-Current Atmospheric Leach (CCAL) process and the extraction of high-value HPA and Ni-Co precursors via exclusively licensed proprietary flowsheet processes
- The Homeville deposit has a current Mineral Resource of:
  - **16.3 million tonnes at 3.1% aluminium, 0.93% nickel and 0.05% cobalt for 505,300 tonnes of aluminium, 151,000 tonnes of nickel and 8,100 tonnes of cobalt (cut-off 0.7% nickel)**



JORC Category	Cut-off Grade Ni%	Tonnes (Mt)	Ni %	Co %	Fe %	Al%
Indicated	0.5	6.4	0.87	0.06	21	3.7
	<b>0.7</b>	<b>4.4</b>	<b>0.99</b>	<b>0.06</b>	<b>20</b>	<b>3.4</b>
	1	1.8	1.21	0.05	19	3
Inferred	0.5	20.7	0.78	0.05	18	3
	<b>0.7</b>	<b>11.9</b>	<b>0.91</b>	<b>0.05</b>	<b>18</b>	<b>3</b>
	1	3.1	1.16	0.05	17	2.7
<b>TOTAL</b>	0.5	27.2	0.8	0.05	19	3.2
	<b>0.7</b>	<b>16.3</b>	<b>0.93</b>	<b>0.05</b>	<b>19</b>	<b>3.1</b>
	1	4.9	1.18	0.05	18	2.8





# High Purity Alumina (HPA)



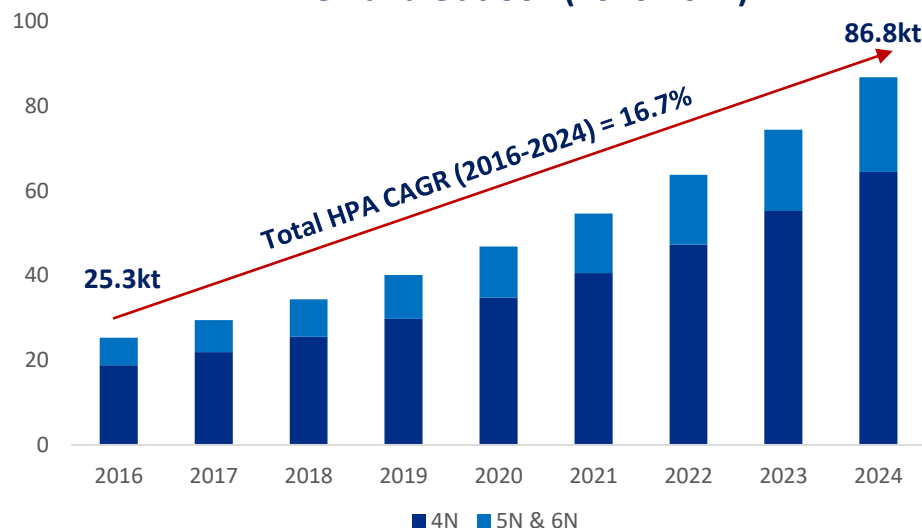
- HPA is the pure form of aluminium oxide ( $Al_2O_3$ )
- Its value derives from its physical properties of extreme hardness & chemical stability
- Price and performance of HPA varies upon product density, particle size and distribution and degree of purity
- Purity is determined by the concentration of trace elements in the alumina compound eg, iron, magnesium, sodium
- **4N HPA is the largest sector of the HPA market and is seen by CLL as the most logical sector of the market in which to focus in terms of demand volumes and margin optimisation**



## How Many 9s?

SGA	99.5% purity	~US\$400/t
3N HPA	99.9% purity	~US\$6,000/t
4N HPA	99.99% purity	~US\$25,000/t
5N HPA	99.999% purity	~US\$50,000/t
6N HPA	99.9999% purity	By negotiation Very limited market

## HPA Demand Outlook (2016-2024)



Source: Persistence Market Research

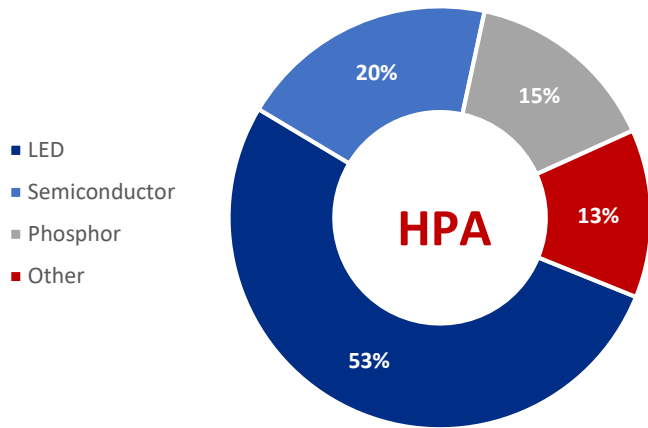
■ 4N ■ 5N & 6N

# Demand for HPA



Demand for HPA is primarily being driven by the increasing adoption of LED (Light Emitting Diode) products, separators in lithium ion batteries and scratch resistant artificial sapphire glass for smartphone screens and watches

## 4N HPA Consumption by Application (2016)

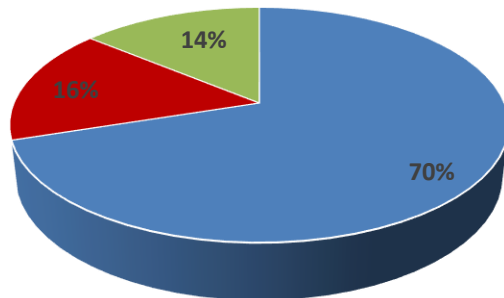


- Growth for HPA has predominantly been driven by LED- based lighting applications which currently account for ~53% of the HPA market. LEDs are expected to account for ~60% of the HPA market by 2020
- Scratch resistant sapphire glass for mobile phone screens and watches, separators in lithium ion batteries and lenses are the fastest growth areas in the HPA market



Source: Persistence Market Research

## HPA Demand by Geographic Region (2016)



■ Asia Pacific ■ Europe/Middle East/Africa ■ Americas

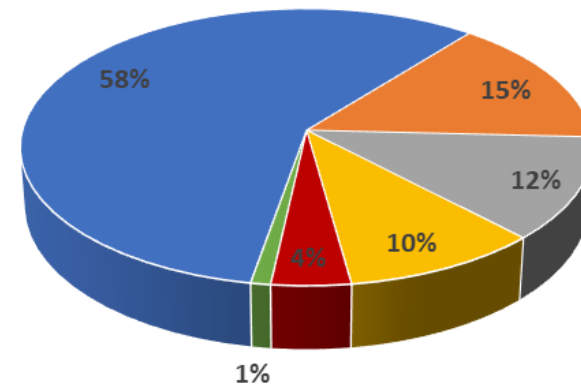
- Growth demand is dominated by the APAC Region (~70% in 2016) primarily China, Japan and South Korea
- As a would-be Australian based HPA producer, CLL is ideally placed to service the most dominant region of global HPA demand

# Supply of HPA



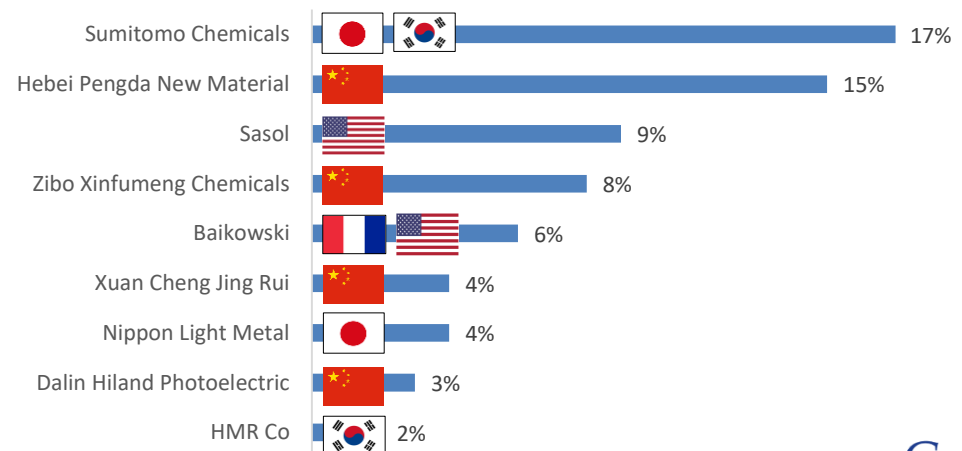
- Current HPA supply is concentrated in the Asia Pacific region (~83%) with China the most prolific producer
- Current production is dominated by large diversified chemical companies where HPA is a non-core product and an immaterial percentage of revenue (< 5% for Sumitomo Chemicals)
- CLL sees enormous opportunity as a focused HPA producer to :
  - Become a genuine alternative supply source to the existing dominant APAC producing countries.....and more importantly
  - Fill an expected supply shortage as forecast HPA demand escalates over the next decade
- CLL stands to become an extremely low-cost HPA producer with its product mix of Ni-Co products offering potentially significant co-product credits
- **Strong potential exists for long-term offtake agreements prior to commercial production**

## Global HPA Supply Distribution - 2016E



■ China ■ Japan ■ North America ■ South Korea ■ France ■ Russia

## % expected 2016 output



Source: Persistence Market Research

# Peer Comparison - HPA Players



CLL plans to distinguish itself from its peers by producing 4N HPA from Laterite Ore



Feedstock	Laterite Ore	Kaolin	Kaolin	Kaolin	Kaolin
Targeted Products	4N HPA ✓ Significant co-products	4N HPA ✓ No co-products	4N HPA No co-products	4N HPA ✓ No co-products	4N HPA ✓ No co-products
Project Stage	PFS Q2 2018	PFS Q2 2018	PFS Q1 2018 DFS mid-2019	BFS 2015 FID Approved	Companies' Creditors Arrangement Act
Metallurgical Process	CCAL + proprietary processes	Acid leaching + proprietary processes	Acid leaching + proprietary processes	Acid leaching + proprietary processes	Acid leaching + proprietary processes
Acid Type	Sulphuric Acid H <sub>2</sub> SO <sub>4</sub>	Hydrochloric Acid HCl	Hydrochloric Acid HCl	Hydrochloric Acid HCl	Hydrochloric Acid HCl
Process Pros/Cons	Leaching at atmospheric pressures. No Pyro-Hydrolysis Lower technical risk	Leaching at high pressures & temp. Pyro-hydrolysis Higher technical risk	Leaching at high pressures & temp. Pyro-hydrolysis Higher technical risk	Leaching at high pressures & temp. Pyro-hydrolysis Higher technical risk	Leaching at high pressures & temp. Pyro-hydrolysis Higher technical risk
Targeted Production	~10,000 tpa	5,000-10,000tpa	???	4,500 tpa	???
Capex	???	???	???	US\$298M	C\$498.5M

✓ Have produced a batch scale 4N HPA sample

# A unique product offering



Deposit geology and exclusive process flowsheet IP uniquely positions CLL for the production of **multiple** high value revenue products of **HPA + nickel & cobalt sulphates + scandium oxide**

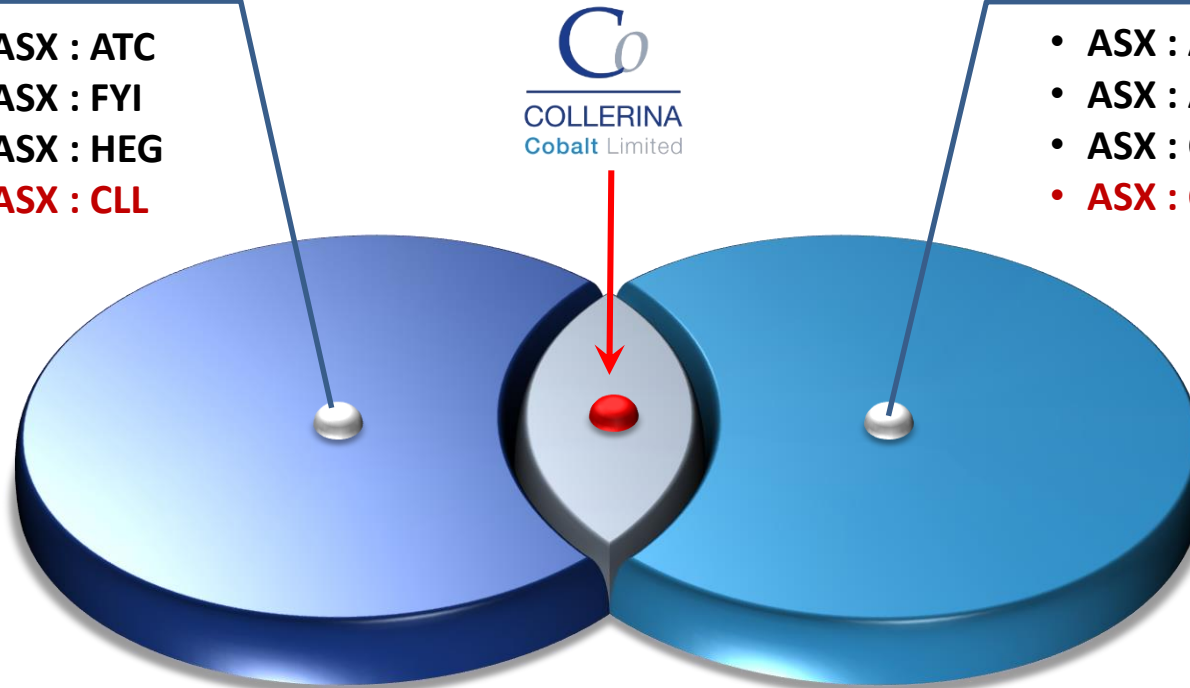
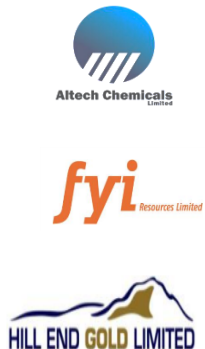
CLL is uniquely positioned across the technology metals spectrum

## HPA Players

- ASX : ATC
- ASX : FYI
- ASX : HEG
- **ASX : CLL**

## Ni-Co-Sc Players

- ASX : ARL
- ASX : AUZ
- ASX : CLQ
- **ASX : CLL**



Co-product mix to have significant implication on net margins

# Peer Comparison - Nickel/Cobalt Players



Project(s)	Collerina	KNP/Cobalt Zone	Sconi/Flemington	Clean TeQ Sunrise
Targeted Products	Ni/Co Sulphate Scandium Oxide	Ni/Co Sulphate Scandium Oxide	Ni/Co Sulphate Scandium Oxide	Ni/Co Sulphate Scandium Oxide
Project Stage	PFS Q2 2018	PFS Q1 2018 DFS mid 2019	PFS 2016 BFS April 2018	PFS 2016 DFS Q1 2018
Metallurgical Process	CCAL + proprietary processes	???	Conventional HPAL + SX	Conventional HPAL + Resin-in-Pulp (RIP)
Acid Type	Sulphuric Acid H <sub>2</sub> SO <sub>4</sub>	???	Sulphuric Acid H <sub>2</sub> SO <sub>4</sub>	Sulphuric Acid H <sub>2</sub> SO <sub>4</sub>
Targeted Production	PFS Outcome	???	Nickel Sulphate ~24kt pa* Cobalt Sulphate ~3kt pa* Scandium Oxide???	Nickel Sulphate ~85kt pa Cobalt Sulphate ~15ktpa Scandium Oxide ???
Capex	PFS Outcome	???	---	US\$680M
Market Capitalisation (Fully Diluted)	<b>\$76.2M</b>	<b>\$192.1M</b>	<b>\$237.3M</b>	<b>\$1,006M</b>

\* Sconi project only

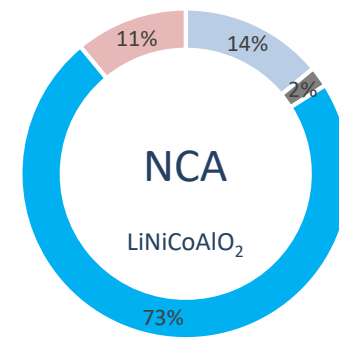
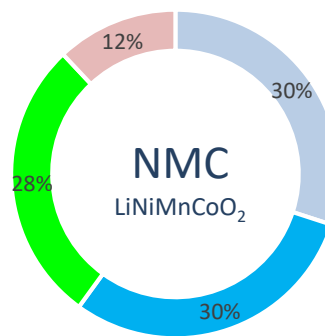
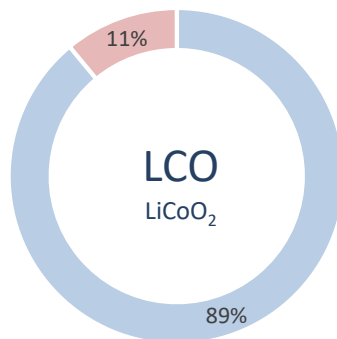
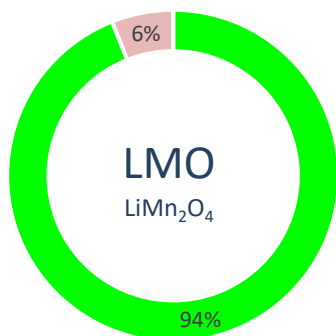


# Nickel-Cobalt Sulphates are in hot demand



Battery chemistries are increasingly moving to Nickel/Cobalt compositions due to superior battery life, energy density and performance stability

■ Cobalt ■ Aluminium ■ Nickel ■ Lithium ■ Manganese



Nissan Leaf



Apple iPhone



Tesla Powerwall



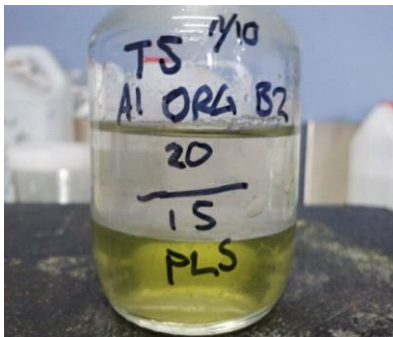
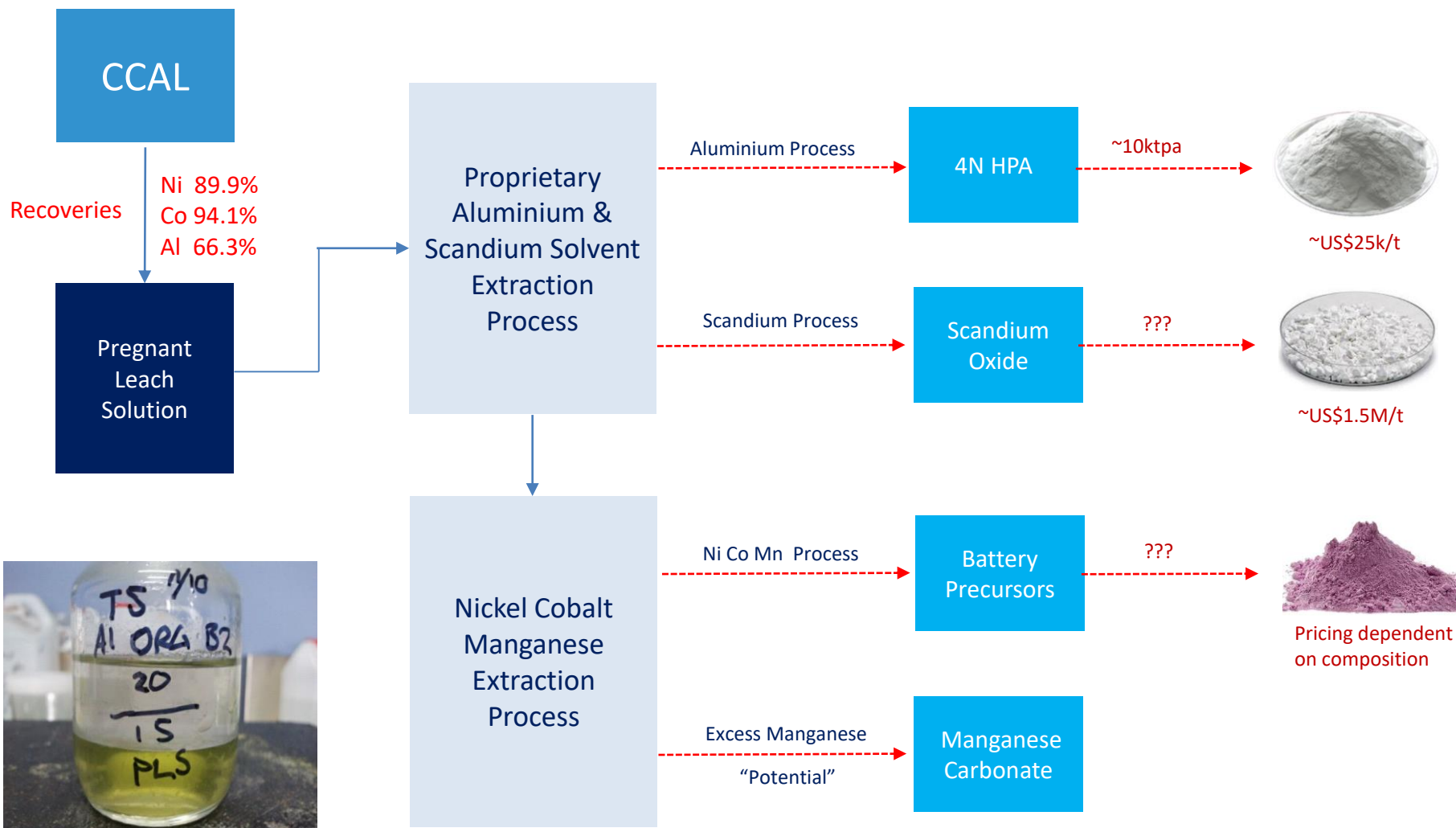
Tesla Model S

Collerina's proprietary process has the potential to produce 'bespoke' battery precursors that are currently commanding premium pricing from end users

# Metallurgical testwork – process flowsheet



CLL's process flowsheet utilises a series of proprietary processes capable of delivering several high-end specialty product streams



Aluminium-depleted PLS

# Indicative timetable



2-Oct 9-Oct 16-Oct 23-Oct 30-Oct 6-Nov 13-Nov 20-Nov 27-Nov 4-Dec 11-Dec 18-Dec 25-Dec 1-Jan 8-Jan 15-Jan 22-Jan

CCAL TESTWORK			
Generation of Pregnant Leach Solution (PLS)	☑		
HPA TESTWORK			
Aluminium Solvent Extraction		☑	
HPA batch sample			☑
Mini-Rig Program*			Expected to be concluded by the second half of March 2018
NI/CO RECOVERY TESTWORK			
Nickel/Cobalt Extraction testing			☑
PRE-FEASIBILITY STUDY			
Testwork incorporated into Pre-feasibility Study	Results of the above testwork will be incorporated into a formal Pre-feasibility study which is scheduled to be concluded in the June Quarter 2018.		

\*The mini-rig program is designed to:

- I. Validate the process flowsheet beyond bench scale
- II. Generate larger product volumes of HPA/Nickel-Cobalt sulphates for marketing to potential end-users
- III. Provide valuable input into the Pre-feasibility study and pilot plant planning phases

# Collerina Cobalt – a value proposition



- Unique deposit geology highly amenable to simple, low cost and well accepted processing techniques
- Licensed proprietary processing technology to deliver multiple high-value product streams
- Anticipated modest capex and high operating margins
- Highly experienced Board and management team with a track record in exploration success and project development
- Numerous milestones to drive shareholder value over the next 12 months

**Norman Seckold**

**Chairman**

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**Rimas Kairaitis**

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**Peter Nightingale**

**Director/Chief Financial Officer**

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**Cameron Peacock**

**Investor Relations and Business Development**

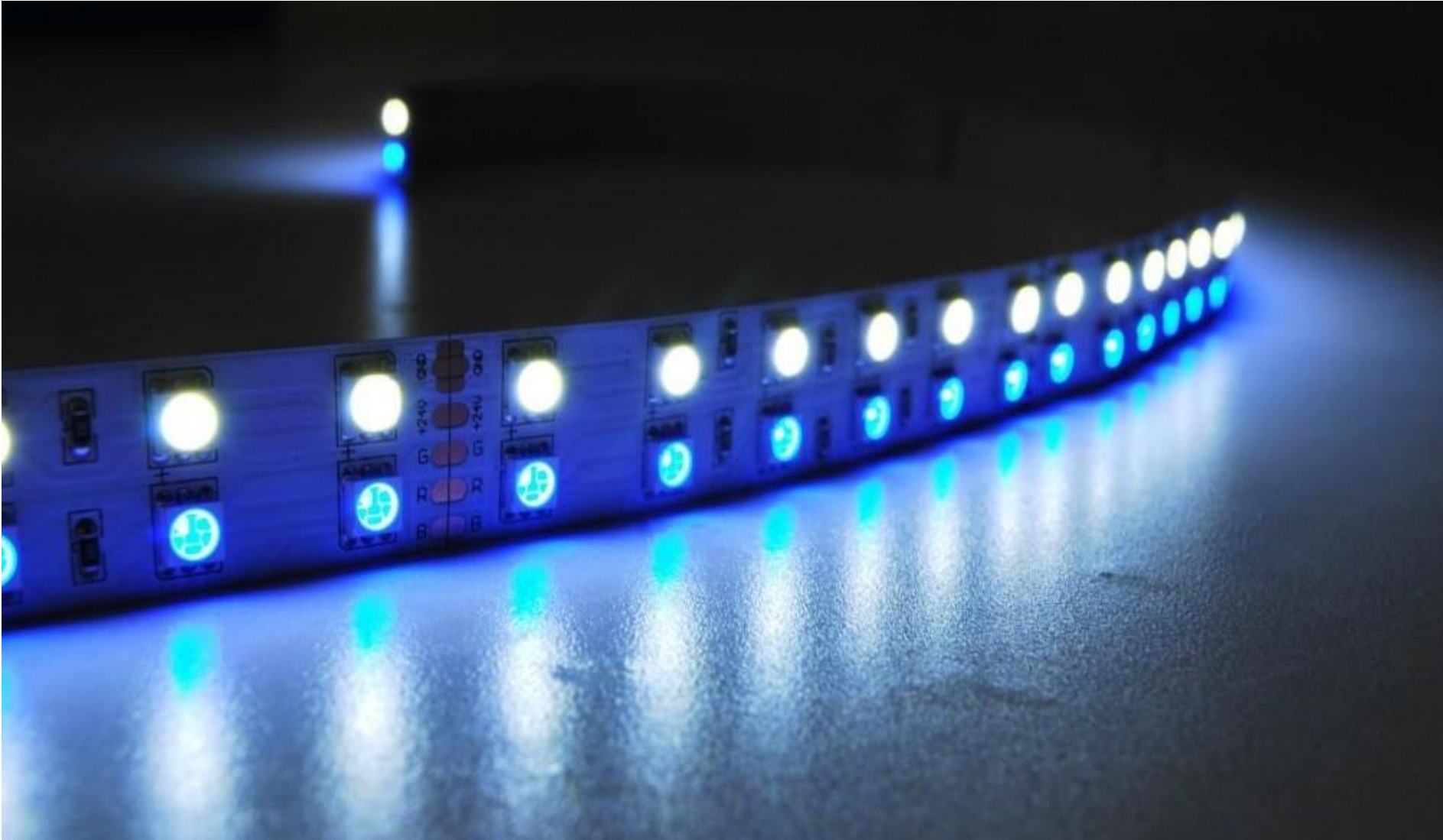
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# Li-Bs are driving nickel - cobalt demand



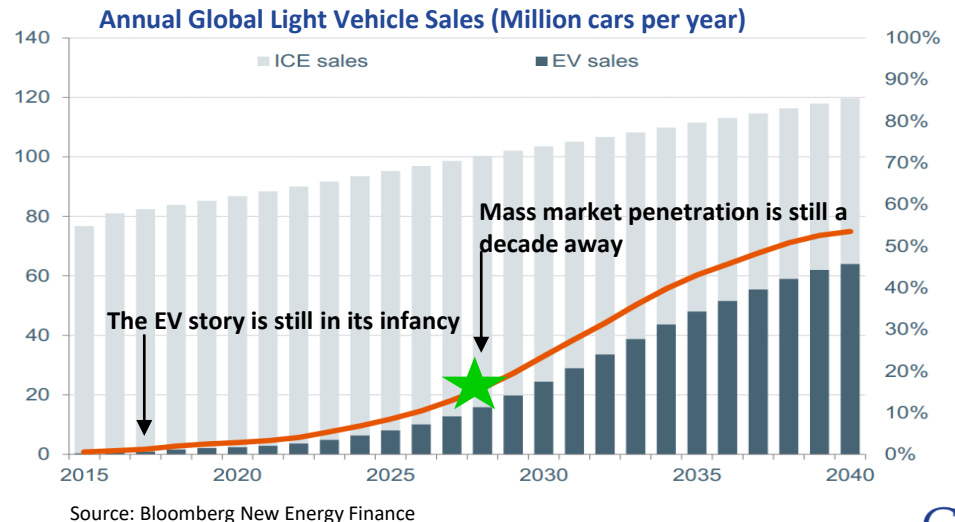
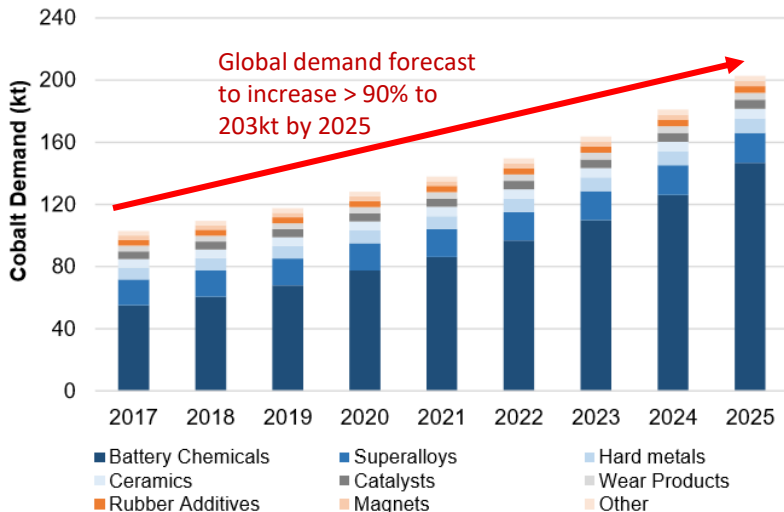
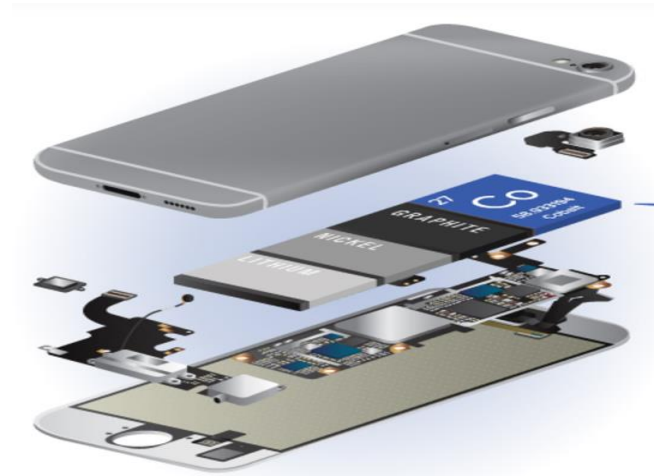
Cobalt is a critical component in the cathode of rechargeable lithium-ion batteries (Li-B's), playing an important role in improving battery life, energy density and stability

**~50%**

world cobalt demand comes from the Li-B market with this percentage set to grow to >75% by 2025

**~75%**

of all batteries are expected to contain cobalt in some capacity led by the continued adoption of mobile phones and EV's



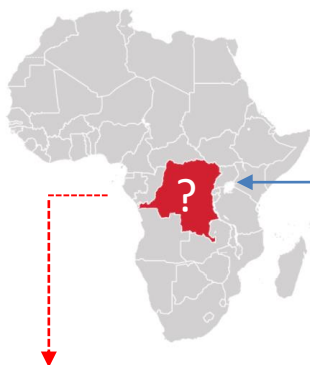
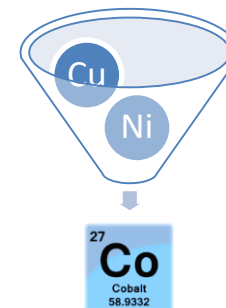
Source: Bloomberg New Energy Finance

# Cobalt - the supply equation



~95%

of global cobalt production results as a by-product of copper and nickel mining meaning future supply is susceptible to the outlook for these metals



~56%

of global production comes from the Democratic Republic of Congo (DRC) of which nearly half is thought to be via artisanal mining



~40%

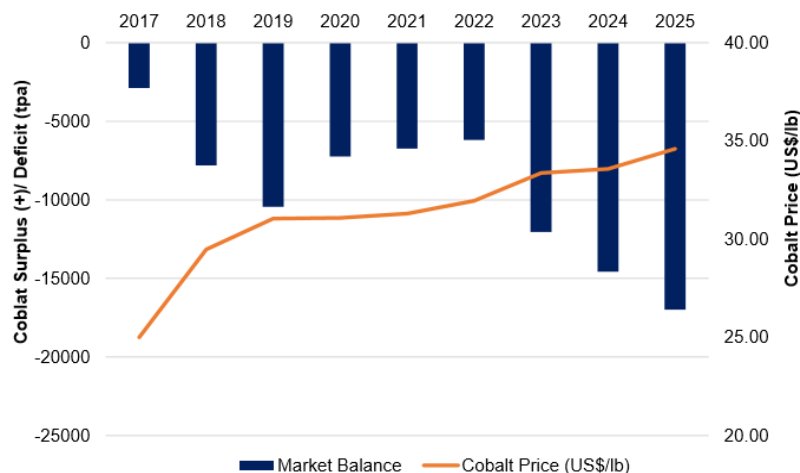
of refined cobalt production comes from China, with ~60% of China's unrefined cobalt sourced from the DRC

With the DRC and China dominating the global cobalt trade there is concentrated supply risk for the remainder of the market



Questions remain over the DRC's political stability with ongoing violence and the constant threat of civil war. The country's widespread use of child labour is also bringing increased scrutiny on the sector's informal mining practices which serve as a threat to continued supply

## Deficits forecast for the foreseeable future...



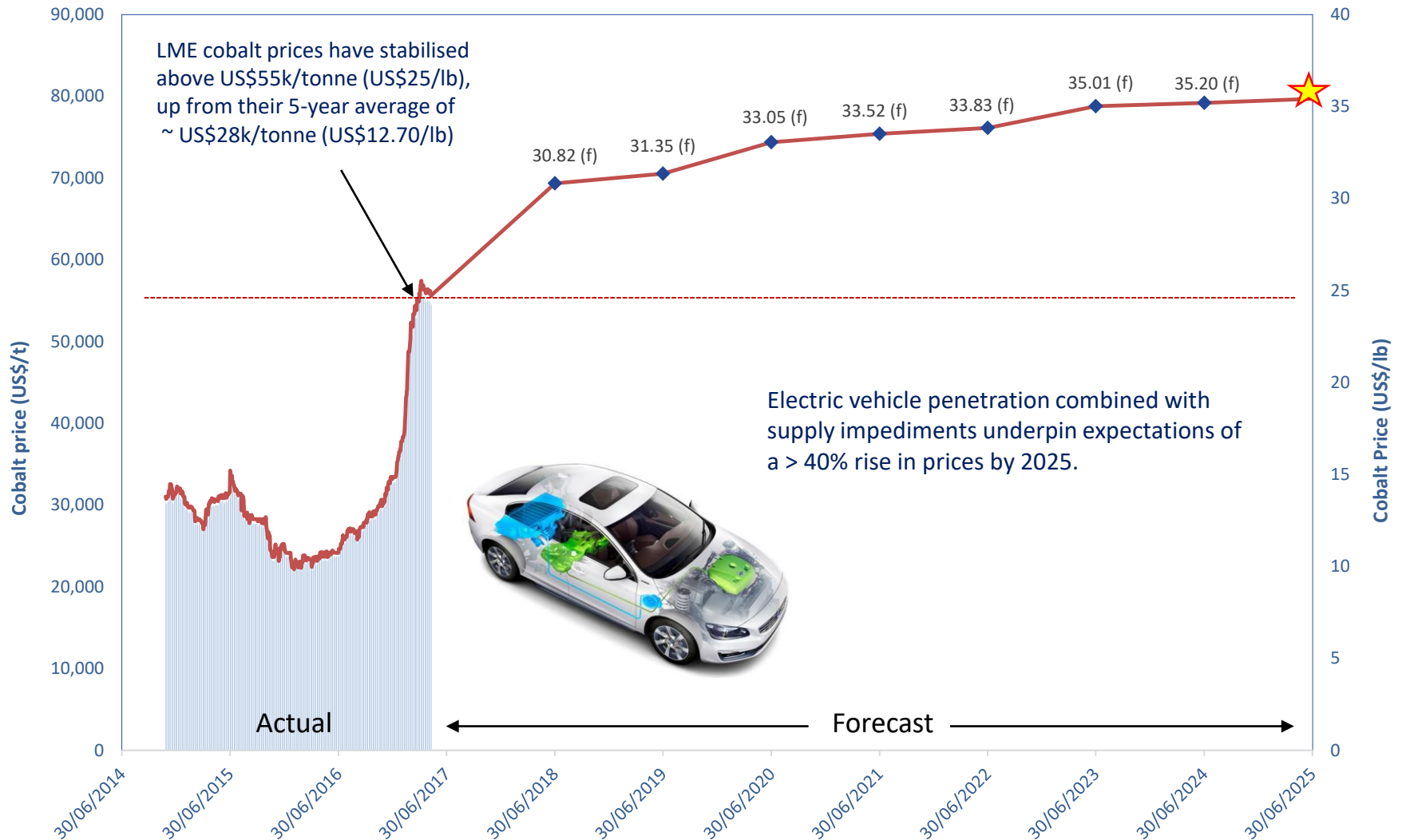
Significant supply constraints combined with robust demand growth are expected to lead to ongoing deficits through at least 2025

Source: Canaccord Genuity

# Cobalt price projection through 2025



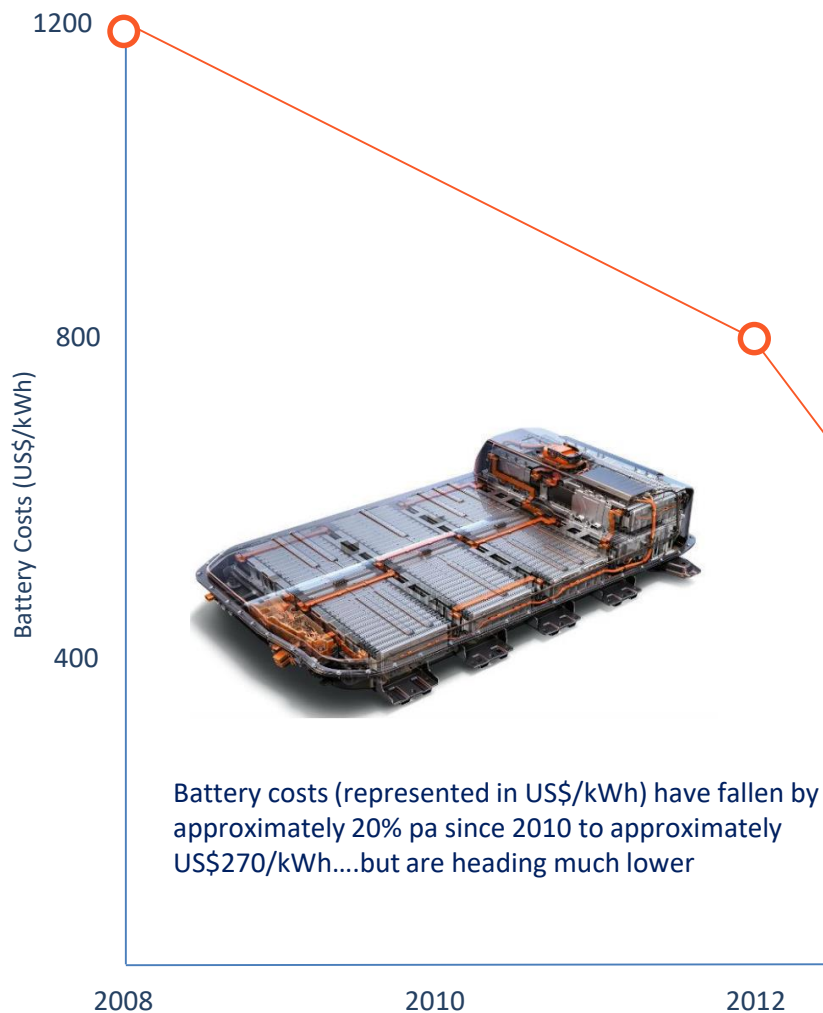
Robust demand fundamentals and a constrained supply-side outlook underpin Cobalt's recent price rise and positive outlook



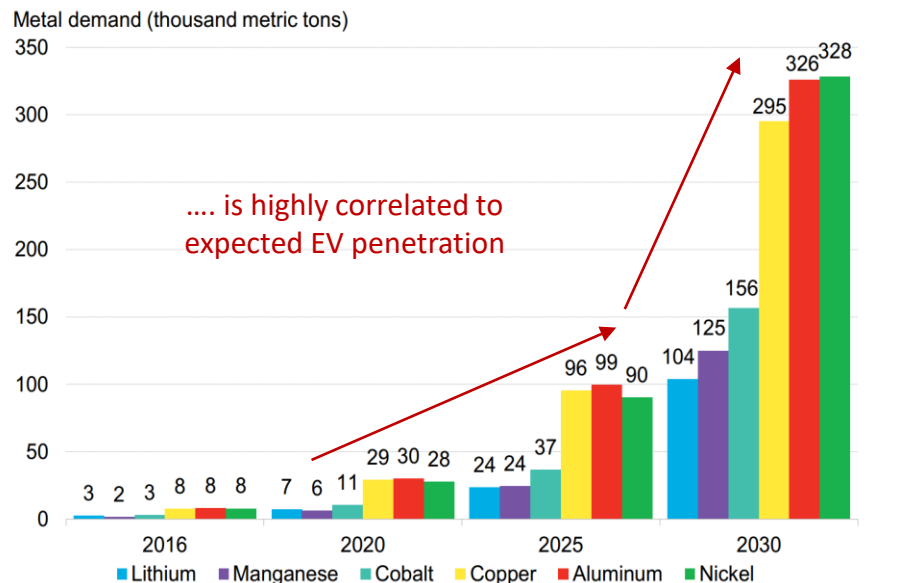
# Battery costs will underpin EV penetration



Batteries with lower cost structures and greater energy densities will drive EV penetration and demand for battery metals



## Forecast demand for key battery materials.....



Source: Bloomberg New Energy Finance

# The CCAL / HPA process



The CCAL process utilises 2 stages of leaching before solvent extraction and refining into High Purity Alumina

## CCAL - Stage 1

Ore is leached in a lower concentrate free acid solution producing a pregnant leach solution with relatively low residual acidity. The leach residue solids from the first stage are then washed and forwarded to the second stage of leaching.

## CCAL - Stage 2

A concentrated sulphuric acid is used to liberate the more tenacious material. The leach solution from the second stage, with a much higher residual acid concentration, is recycled to the first stage leach as the acid source.

## HPA Processing

A low acidity Pregnant Leach Solution (PLS) from the CCAL process is subject to propriety solvent extraction and refining steps with the aim of producing a 4N (99.99% purity) HPA.

## Nickel and Cobalt recovery

Testwork is using propriety processes are being investigated to produce high purity/high value Ni-Co products from residual solution.



Settling test on CCAL discharge slurry (separation of residue solids from pregnant solution).



# Statement of Compliance



## Compliance Statement

Information regarding the Mineral Resource at the Collerina project was prepared and first disclosed under the 2004 Edition of the 'Australasian Code for Reporting of 'Exploration Results, Mineral Resources and Ore Reserves'. See ASX announcement dated 23 June 2011. It has not been updated since to comply with the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves' on the basis that the Company is not aware of any new information or data that materially affects the information and, in the case of the resource estimate, all material assumptions and technical parameters underpinning the estimate continue to apply and have not materially changed.

The information in this report that relates to Mineral Resources is based on information compiled by Collerina Cobalt staff and contractors and approved by Mr Michael Corey, PGeo., who is a Member of the Association of Professional Geoscientists of Ontario (APGO) in Canada. Mr Corey is employed by the Company and has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Corey has consented to the inclusion in this report of the matters based on his information in the form and context in which they appear.

Information in this announcement relating to the process development testwork is based on test work results compiled by Mr Boyd Willis, an Independent Consultant trading as Boyd Willis Hydromet Consulting. See ASX announcement dated 24 November 2017. The Company is not aware of any new information or data that materially affects the information and all material assumptions and technical parameters underpinning the process development testwork continue to apply and have not materially changed. Mr Willis is a Fellow and Chartered Professional of The Australasian Institute of Mining and Metallurgy (AusIMM). Mr Willis has sufficient experience which is relevant to metal recovery from the style of mineralisation and type of deposits under consideration and to the activity which he is undertaking to qualify as a Competent Persons under the 2012 Edition of the 'Australasian Code for reporting of Exploration Results, Mineral Resources and Ore Reserves'. This includes over 21 years of experience in metal recovery from Laterite ore. Mr Willis consents to the inclusion of the technical data in the form and context in which it appears.