

# **Cobalt** – our increasing dependency

### **Consumer Electronics**

### SMART PHONE

Size = 5.5 Wh

Cobalt: 6grams (\*A\$0.50)



#### **TABLET**

Size = 20 Wh

**Cobalt 23 grams** (\*A\$1.90)



### **Cobalt Oxides**

#### LAPTOP

Size = 30 Wh

Cobalt 33 grams (\*A\$2.60)



### **Technology Disruption**

### FIXED STORAGE

Size = 7 kWh

Cobalt: 3 kgs (\*A\$240)



### **Cobalt Sulphates**

### BATTERY ELECTRIC VEHICLE

Size = 85 kWh

Cobalt 15 kgs (\*A\$1,200)



#### WIDE BODY AIRCRAFT

A380 shown (4 engine)

Cobalt: 4,500 kgs (\*A\$360,000)



### **Evolution of Superalloys**

#### 1958: BOEING 707

**Cobalt: 15 kgs** (\*A\$1,200)



### 1994: BOEING 747

10x cobalt for <4x weight B707

Cobalt: 650kg (\*A\$50,000)



### 2006: Airbus A380

20x cobalt for <6x weight B707

Cobalt: 4,500kgs (\*A\$360,000)

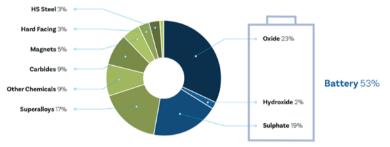




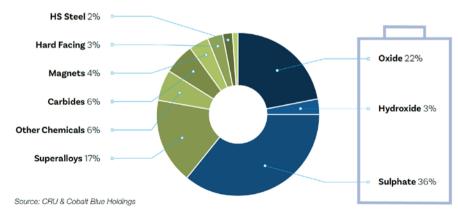
## **Cobalt Demand** +70% next decade

## ......driven by >300% Cobalt Sulphate

#### Cobalt Demand 2017 - Actual



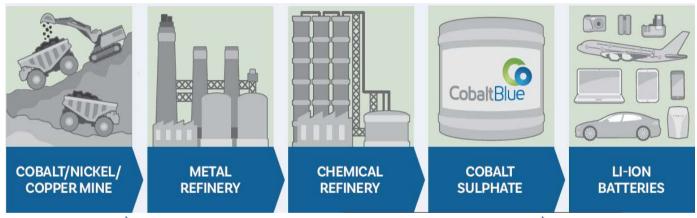
#### Cobalt Demand 2026 - Forecast

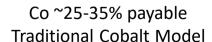


Battery 61%



# **Thackaringa** – mine to battery strategy





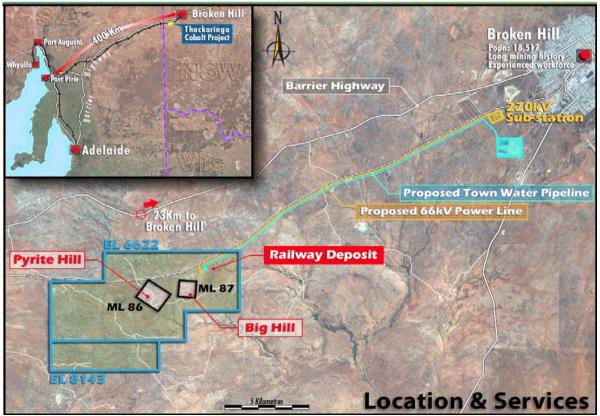


Cobalt Blue Model

Source: Cobalt Blue Holdings Ltd



# Thackaringa – People, Power, Water, Road, Rail

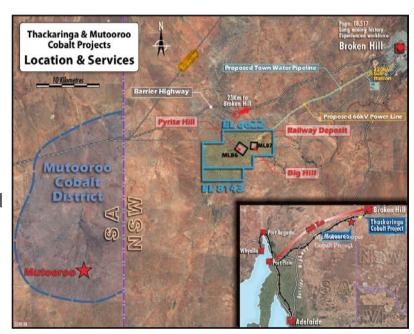




## **Cobalt Blue** = Thackaringa + Process

## COB takes first step in process rollout

- ✓ Cobalt Blue beyond Thackaringa
- ✓ Cooperation with Havilah Resources
- ✓ Potential cobalt district in Broken Hill



Source: Havilah Resources & Cobalt Blue Holdings



# **The Cobalt Blue Management Team**

"Extensive expertise in mineral exploration and mine development, investment management, corporate law and energy storage."



#### Chief Executive Officer – Joe Kaderavek

- Deutsche Bank, Head of Resources, equities / investment management, resources and energy storage technology focus
- PricewaterhouseCoopers performing operational reviews and strategic assessments across mining, minerals processing, railway and port facilities throughout Australia, North America and Europe; worked extensively on secondment to BHPB and Rio Tinto
- International consulting role focused on renewable energy / battery storage technologies

#### Director & Joint-Venture Manager - Anthony "Trangie" Johnston

- Geologist with 20 years exploration, project development and mining experience
- Career spans the private, public, consulting and government sectors, with experience both throughout Australia and internationally
- CEO of Broken Hill Prospecting, a diversified minerals sands developer

### Executive Manager - Dr Andrew Tong

- Metallurgist with nearly 15 years experience in project development, operating mining and processing activities, and patenting innovative minerals processing technology
- Non-executive director of Northern Territories Resources Pty Ltd
- Owner of Minerals and Residues Pty Ltd, which provides metallurgical consulting and testwork, and corporate management and advisory services
- Formerly CEO of Compass Resources (Australia), and CEO of Goldsmith Resources (Peru)

Independent Chairman – Robert Biancardi Independent Director – Hugh Keller Independent Director – Matt Hill

More Information www.cobaltblueholdings.com
Email joe.kaderavek@cobaltblueholdings.com
ASX Code COB



## **COB** – World Class Integrated Cobalt Refinery

- √ Top 5 global cobalt supplier 20,000tpa cobalt sulphate with >20 year life.
- √ Thackaringa natural advantage cobalt + sulphur
- ✓ COB only primary cobalt play listed on ASX
- ✓ Australia safe and secure jurisdiction

### **Share Catalysts:**

- √ 3 months Pre Feasibility Study introduce Thackaringa as a world class asset
- √ 15 months Bankable Feasibility Study

### COBALT BLUE ASPIRES TO BE A TOP 5 GLOBAL PRODUCER





## **Cobalt Blue Achievements**

- 1. IPO February 2017
- Scoping Study January June 2017 showed positive project potential (not released to market)
  - ✓ Drilled 22 diamond holes, and 38 RC holes for 12,000 m
  - ✓ Upgraded resource to 54.9Mt at 900 ppm Cobalt = 50,000 t Co
- 3. Commenced Pre-Feasibility Study August 2017 due June 2018
  - □ Drilling 13,000 m
  - Upgraded resource due Q1 2018
  - Metallurgical testwork demonstrating high cobalt recoveries



## "CY18 - another big year for Cobalt Blue"

### >13,000m of drilling targeted for CY18

One of the largest cobalt exploration commitments on the ASX

ASPIRATIONAL TARGET: Significant improvement in size of the Thackaringa cobalt deposit

= A global top 5 mining operation with 20 year + life

#### **OUR SCHEDULE OF WORK IS AS FOLLOWS:**

Aug 2016 - Feb 2017	1 April 2018	30 June 2018	30 June 2019	
Complete	Stage One	Stage Two	Stage Three	Stage
Cobalt Blue formed JV & Farm-in JORC 2012 upgrade Cobalt Blue listed	A\$2.0m expenditure in the ground delivered.  Delivered: Inferred Resource Upgrade Scoping Study Deliver: Indicated Resource Upgrade Aerial Geophysical Program Target Date: 1 April 2018	A\$2.5m expenditure in ground – Indicated Resource Target Deliver: Preliminary Feasibility Study Target Date: 30 June 2018	A\$5.0m expenditure in ground – Measured Resource + Reserves Target Deliver: Bankable Feasibility Study + Project Approvals Target Date: 30 June 2019	Project Finance



# **Cobalt** – less growth

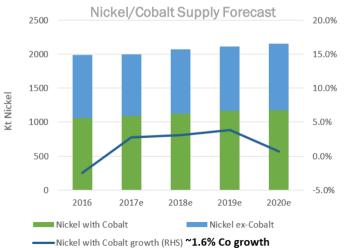
### Cobalt supply constrained

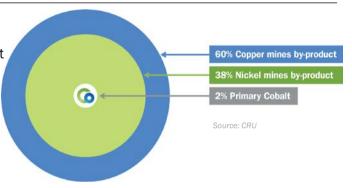
 Cobalt supply growth in copper/nickel by-product will average 3-4% to 2020.

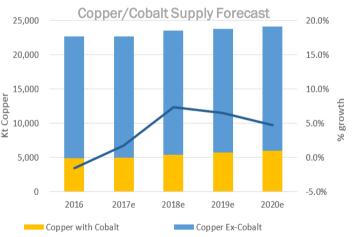
Cobalt demand growth will average 9% to 2020.

Forecast cobalt shortage of 10-20Kt by 2020.

 Cobalt Blue tonnes are required for market balance in the longer term.









-Copper with Cobalt growth (RHS) ~3.7% Co growth

# **Cobalt** – the new energy revolution

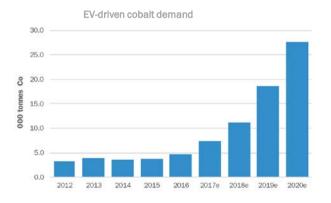
The New Energy sector is disruptive, rapidly evolving, and delivering returns

#### **INCREASINGLY INVESTABLE:**

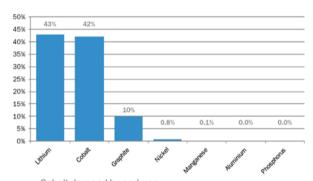
Cyclical winners and losers as the sector progresses.

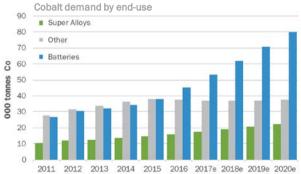
#### **RAW MATERIALS:**

- Cobalt is a vital component in rechargeable batteries
- EV penetration rate of 1% by 2020 increases auto battery cobalt demand by 44% CAGR



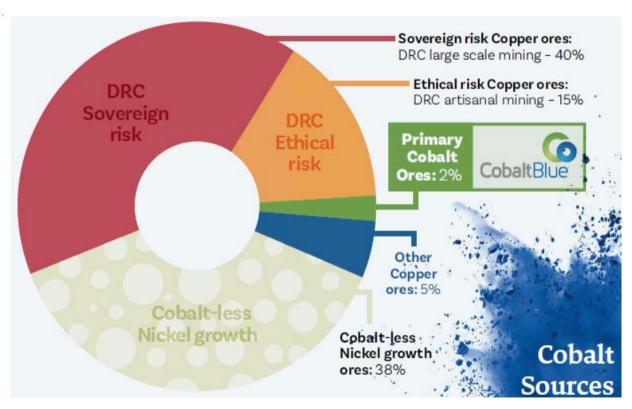
#### Share of raw materials' end-use in batteries, 2015





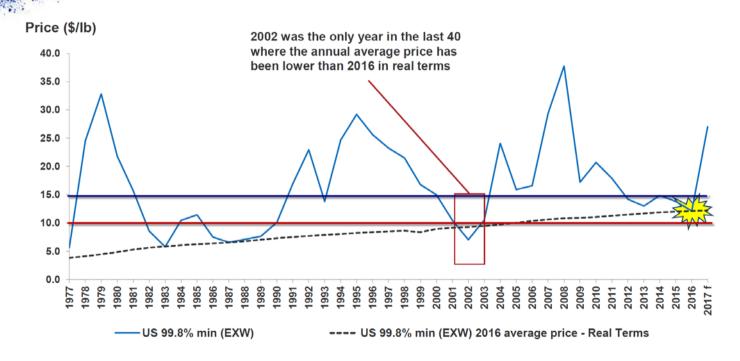


# **Cobalt Market** - Supply Side at Risk



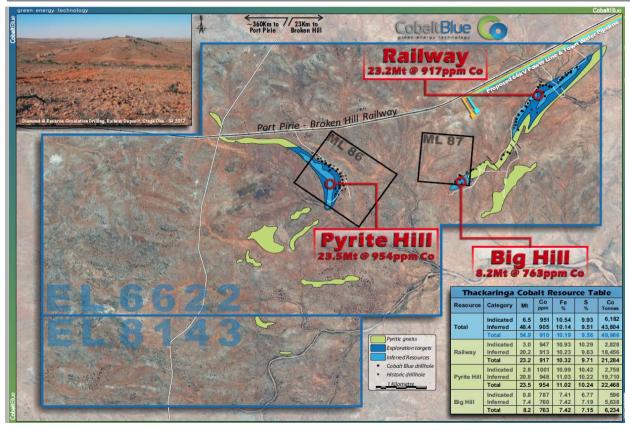


# Thackaringa – Historical cobalt pricing





# **Thackaringa** – Site Layout

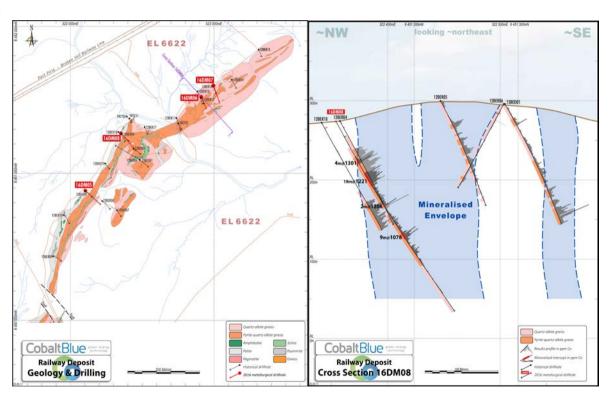


# **Thackaringa** – significant defined resources

Category	Mt	Co ppm	Fe %	<b>s</b> %	Pyrite %	Co Tonnes	Py Mt	Density
Railway (at a	a 500ppm (	Co cut-off)						
Indicated	23	854	10.1	9.2	17	19,400	4	2.85
Inferred	14	801	10.4	9.2	17	11,100	2	2.85
Total	37	842	10.2	9.2	17	30,800	6	2.85
Big Hill (at a	500ppm C	o cut-off)						
Indicated	7	712	7.2	6.9	13	5,200	1	2.77
Inferred	2	658	6.7	6.3	12	1,500	0	2.76
Total	10	697	7.1	6.7	13	6,700	1	2.77
Pyrite Hill (a	t a 500ppn	n Co cut-off)						
Indicated	22	937	10.9	10.3	19	20,300	4	2.87
Inferred	4	920	11.2	10.8	20	4,000	1	2.89
Total	26	934	10.9	10.3	19	24,200	5	2.88
Total (at a 50	00ppm Co	cut-off)						
Indicated	52	869	10.0	9.3	17	44,900	9	2.85
Inferred	20	810	10.1	9.2	17	16,600	4	2.85
Total	72	852	10.0	9.3	17	61,500	13	2.85



# **Thackaringa** – Railway Deposit

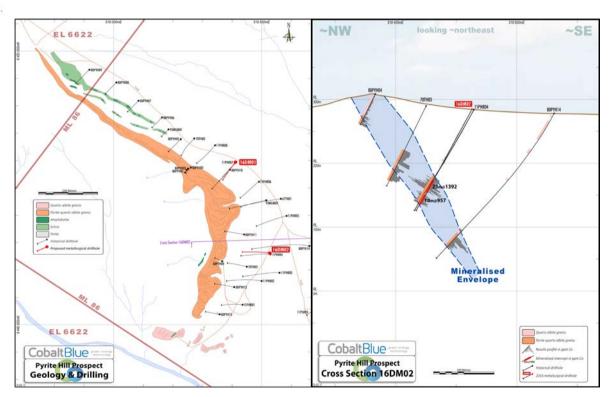


Railway Deposit

Source: Cobalt Blue Holdings



# **Thackaringa** - Pyrite Hill Deposit











# **Thackaringa** - processing summary

MINE

CONCENTRATE

CALCINE

LEACH

**PRODUCT RECOVERY** 

### Mine

ROM 800–1200ppm Co Co inside FeS, mineral

### Concentrate

Crush, grind, gravity, float
Cons = 0.4–0.5% Co
90–95% recovery
~150–200 microns

### **Process**

Pyro-hydro met 95–98% Co recovery 90% S recovery 90% Fe recovery

### **Product**

CoSO<sub>4</sub>.7H<sub>2</sub>O Cobalt Sulphate crystals Elemental Sulphur Iron Oxide (Fe<sub>2</sub>O<sub>3</sub>)











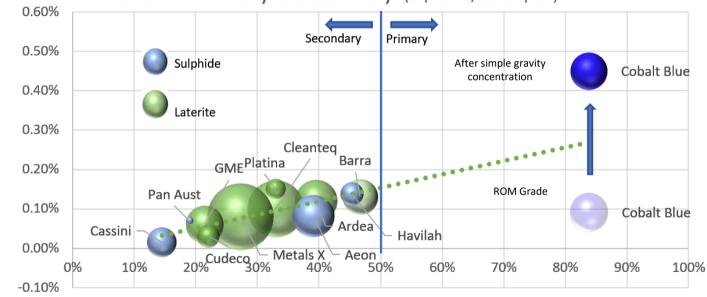
Source: June 2017 Scoping Study - Cobalt Blue Holdings

Minimum target payment terms: 100% LME cobalt pricing High-grade cobalt sulphate crystals possible for 5-10% premium margin



# **Thackaringa** – Comparison with ASX peers





ROM Grade (%Co)

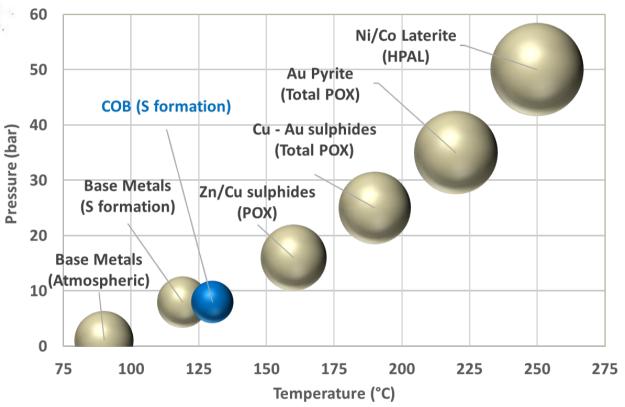
Co (% Revenue Stream)

Source: Cobalt Blue Holdings Ltd

Note: Revenue stream figures are based solely upon head grades converted in revenues at spot prices.



# **COB** – Position in POX Industry



# **Processing** - Concentrate

MINE

CONCENTRATE

CALCINE

**LEACH** 

PRODUCT RECOVERY

Testwork material - 820 kg of ore composited in August 2017.

Ore was crushed to p100 @ 1.2 mm and passed through a gravity spiral circuit. The tails were screened, with the fines subjected to froth flotation. The gravity and flotation concentrates were combined into a single concentrate.

### Key outcomes:

- ☐ High (92%) cobalt recovery to concentrate from ore
- Cobalt recovery achieved with coarse crush size of 1.2 mm and gravity separation, indicating low capital and operating costs compared to fine milling and floating the entire ore



Concentrate testwork – simple gravity spirals delivering exceptional results

Source: Metallurgical testwork - Cobalt Blue Holdings



# **Processing** – Calcine & Leach

MINE

CONCENTRATE

CALCINE

LEACH

**PRODUCT RECOVERY** 

100 kg of concentrate produced in November is being treated through the calcine and leach unit operations.

The concentrate is thermally treated to remove some of the sulphur into the gas phase. The resulting solid calcine is then leached to extract cobalt into solution.

#### Key outcomes:

- ☐ Calcining the gravity concentrate typically removes ~35% of the sulphur from the pyrite
- ☐ The resulting elemental sulphur condensed from the gas phases averaged 97.5% Sulphur. Improved engineering design is expected to improve the quality of the sulphur in future testwork
- There are no losses of cobalt to the gas phases in the thermal treatment step
- Leaching of the calcine achieved cobalt recoveries ranging from ~70% to 96%. The leach parameters are still being optimised





Above: Laboratory-scale furnace & elemental sulphur condenser. Below: Photos of the feed concentrate, residual calcine and collected elemental sulphur.

Source: Metallurgical testwork - Cobalt Blue Holdings



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The information in this report that relates to exploration results, Mineral Resources and Targets is based on information compiled by Mr Anthony Johnston, BSc (Hons), who is a Member of the Australian Institute of Mining and Metallurgy and who is a non-executive director of Cobalt Blue Holdings Limited and the Chief Executive Officer of Broken Hill Prospecting Limited. Mr Johnston has sufficient experience which is relevant to the style of mineralisation and type of deposits under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2004 & 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Johnston consents to the inclusion in the announcement of the matters based on his information in the form and context that the information appears

